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ABSTRACT

Provided in this document are descriptions of reforestation projects and techniques presented by Peace Corps volunteers from Chad, Ivory Coast, Upper Volta, and Niger. The purpose of the document is to aid individuals in trying to find solutions to the problems facing forestry in the Sahel. These projects include: (1) reforestation of Ronier palm ("Borassus aethiopum") in the Dallo Maouri; (2) development of village nurseries in the Kongoussi region of Upper Volta; (3) the Yegelalan sand dune stabilization project; (4) Acacia Albida Project in Chad (establishing strands of "Acacia Albida" trees in grain fields); and (5) the Dougui forestry project, which focuses on reforestation through protection of natural regeneration. Also included are reports from the 1977 Peace Corps Forestry Conference. These reports focus on: windbreak planting; direct seeding of "Acacia senegal"; village reforestation; afforestation in N'Guigmi; vegetation inventory of the Dinderesso Foret Classe; determination of the proper date to commence planting; planting in relation to rainfall; village woodlots at Magaria; and vegetation/habitat type-map of Park National de W du Niger. Schedule of the 1978 conference and notes from workshops of desertification are also provided. (JN)

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Peace Corps

VOLUNTEER NOTES ON REFORESTATION

Niger Forestry Conference 1978

Compiled by Steve Seefeldt

Peace Corps
Information Collection and Exchange
Reprint R-45
September 1982

Introduction

The Peace Corps Niger Forestry Conference, held in Niamey, the 25-30 October 1978 and attended by Peace Corps volunteers from Chad, Ivory Coast, Upper Volta and Niger, Eaux et Forêts personel from Chad and Niger, plus representatives from the various funding organizations in Niger, resulted in this paper which is a collection of some of the projects, thoughts and techniques of the Peace Corps Volunteers. The reason for writing up this collection of reports and notes is to disseminate the ideas and projects of the participants to other interested people which will hopefully lead to a greater interaction between everyone in trying to find solutions to the problems facing forestry in the Sahel. Purposes of this conference were firstly, to provide a medium where ideas and opinions, concerning forestry in many of its aspects, could be freely exchanged, and secondly to show, through field trips, where we are now in the state of the art of Forestry Techniques.

Many of the individual presentations in the 1977 Peace Corps Forestry Conference in Niamey, Niger contained valuable information which needed to be published. Since that information is directly related to this years, it was included in this paper in an additional section.

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INTRODUCTORY SPEECH OF THE 1978

PEACE CORPS FORESTRY CONFERENCE

NIAMEY - NIGER

October 25

by

Mr. Abdou Daoure

Assistant Director of the Waters and Forests Service

(This is an unofficial translation
from the French.)

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Assistant Director of Peace Corps
The Volunteers
Honored Guests

I am honored to welcome all participants to this meeting on behalf of Mr. Najada Ibrahim, National Director of Waters and Forests. Although he is unable to be here he gives his full support to the noble ideals which so well underscores the activities of forestry development.

This meeting stems from the volunteers' concern to effectively increase their participation in our Forestry service by combatting the multiple attacks of desertification.

The efforts of the volunteers is recognized in several ways. In effect we have seen him participate actively in all practical phases of reforestation; from caring for plants in the nursery to their transfer to the plantation and finally to their enclosure. We have even seen the volunteer interest himself in forestry management matters such as the raising of study plots and the study of vegetation. We have also seen the volunteer contribute to the initiation of small projects in response to the needs of the rural population. Two such examples are shade tree and street plantings.

All this effort is expended by the volunteer with a remarkable degree of patience and forebearance beneficial under the harsh environmental conditions of rural life and the difficulty working with insufficient materials.

Members of the Peace Corps, your participation in forestry development has been noteworthy. The forestry agents with whom you have been working for several years appreciate the support you have given.

I will not go into detail about our forestry programs because of the talks which follow and because you can discover them on visits within the country. I will only mention two objectives that we have :

- The satisfaction of the wood needs of the rural as well as the urban population, given the real deficit existence of this material used by more than 90% of our population.

- To protect against erosion, given the fragility of our agricultural lands the mobility of sand dunes and the harshness of the environment.

The volunteer's role in these objectives are considered useful and constructive because the forests constitute a powerful stimulant to the agricultural economy which is looking forward to more self-sufficiency; also because reforestation contributes to the improvement of the environment, and to the attractiveness of the framework of man's life.

However, many of you along with our forestry agents have come to realize and deal with the hard realities of our environment and the immensity of the task.

That is why I wish you strength in the many activities of which you and the forestry agent are a part. To those who are already seasoned her in Niger, or in the other neighboring and friendly countries, I wish to you perserverance, to the newcomers - courage. These are the necessary qualities that the volunteer must already have because action alone is not worth as much without determination.

Assistant Director of the Peace Corps, honored guests, volunteers, I am convinced that the exchange of experiences expressing the important practical work which confronted the volunteers will be of interest to one and all. Some examples are, the dune stabilization in Keita in the Tahoua Department and also the original tally of gum trees in the classified forest at Mainé-Soroa in the Diffa Department. The development of the forestry sector in humid countries like Ivory Coast presents some differences compared to a Sahel country like Niger.

In order not to repeat myself I will say that we are agreed on the approach to research, the goal of this meeting

To conclude I therefore wish full success to the work of this important meeting for the improvement of the forestry sector.

Individual Presentations of Projects

Reforestation of Rônier Palm in the Dallol Maouri : Niger

by

Ben Bastyr
Peace Corps
Niger

20 October, 1978

Reforestation of Rônier Palm in the Dallol Maouri : Niger

Introduction

The Dallol Maouri, in the southernmost sector of Niger, is a lowland valley found in the Wooded Savanna vegetation zone. It is a narrow belt extending from Gaya to Guéza (approx. 45 kilometers N to S) and is very adequate for the growth of Rônier palm. (Borassus aethiopum). Rainfall in the Dallol varies from 750-1000 mm annually.

The project I am currently involved in is a 3 year reforestation of Borassus aethiopum in the Dallol. (1978-80). Due to advancing dunes and over - exploitation in recent years, the rônier has been reduced in numbers considerably, and the demand for the wood, for building purposes, has increased. The Project, funded by Fund Français d'Aide Cooperation (FAC), calls for a reforestation of 900 hectars of rônier palm every year, for 3 years, thus completely encompassing the estimated 2700 hectars in the Dallol. The 100 million CFA that have been appropriated, will supply for one Saviem truck, two Landrovers, one tractor, and all resources necessary to plant, fence, and protect the 2700 hectars.

Work Schedule

Under the direction of Mr. Lawali ADA, the project work-force includes 2 Niger technical agents, myself, and at the present time, 38 workers who have been hired from the local area. This year we are working out of Sabon Birni, a village bordering the Dallol, 23 kilometers NE of Gaya. Each year as the work progresses further north up the Dallol workers who wish to continue on the project can move into villages near the plantation. Any additional workers that we may need will be hired from these villages.

We try to follow a schedule or work cycle throughout the course of a year. Although there may be small changes made to speed up the work a bit, we try to accomplish things in this order: 1) delineate and map the plantation boundaries, 2) piquetage on a 6 x 6 m. spacing, 3) plant the rônier, 4) construct a fence around the plantation, and finally, 5) cut a fireline around the plantation. Once this is completed, mature rônier can be marked and cut within specific exploitation zones in the Dallol .

A. Delineation and Mapping

This year, 3 parcels have been surveyed and mapped. These parcels, totalling approx. 600 hectares, are located between Sabon Birni and Tounouga, a small bush village 10 kilometers south of Sabon Birni. Of the three parcels, parcel A (approx. 45 hectares) is immediately adjacent to Sabon Birni. This area, now void of rônier, was dense with trees only 10-15 years ago. Dune advancement and overexploitation seem to be the cause. Parcel B, the largest (approx. 500 hectares) extends 7 kilometers from Sabon Birni, South to near Tounouga. Parcel C (45 hectares) is adjacent to Tounouga, and was surveyed late in July and early August. Because we were so far behind schedule, and parcel B was not completely planted yet, we had to abandon parcel C, with

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only 7 hectares planted, and finish parcel B before we were too far into the rainy season.

I used a builders level, a good field compass, and a 50 m. chain to survey the parcel boundaries. The best procedure for this, was with a chainmen, one rod man and one man to place piquets. The workers were completely unfamiliar with the equipment and procedure, but after a couple of days quickly caught on.

Problems seemed to present themselves regularly, and we discovered new and more efficient methods for getting the survey done. My piquets, that were placed in 50 m. intervals were constantly removed by locals, and had to be replaced several times. One means of eliminating this problem, and thus saving a great deal of time, would be to build the fence immediately after the survey of a parcel. This year there was a long time lag after the survey simply because we had to plant immediately. It should be mentioned here that we were at a considerable disadvantage this year in terms of scheduling, availability of materials and administrative problems, because the project was in its infancy, and we were not able to start before June. Also, through experience, as I shall point out, we realized that the idealistic methods we were using, were too time consuming and not realistic in this situation. Next years survey will involve, surveying and mapping 1300 hectars, thus gaining the 300 hecteres we were not able to plant this year. This number is high but very realistic, as I will begin surveying in January and not July, when tall millet slows the work considerably.

I have the use of a builders level in my work which is a nice convenience, and of course very precise. This equipment is often not available in the field, where only a compass is on hand. The use of a good compass for laying out a survey of this kind, would suffice very well, and would give the desired results with little error.

B. Piquetage

The method we began with for the piquetage, turned out to be the most time consuming, difficult, frustrating and educational work operation to date. The workers had spent several weeks cutting piquets in preparation for our June piquetage. The work plan calls for rônier to be planted on a 6 x 6 meter spacing, and we went through great efforts to achieve exactly that. Our resources consisted of a 30 m. chain, two 100 m. ropes, a builders level, 8 surveying rods, and 40 workers, all of which were painstakingly utilized. However, the idea for the piquetage seemed reasonable. Take a 100 m. rope and tie knots every 6 meters along its length. Once in the plantation simply extend the rope between 2 parallel lines and move along, 6 meters at a time, placing piquets at each knot along the rope. The parallel lines were made by making one central line and drawing perpendiculars from that every 30 meters with the level and rods. This is where we ran into problems. Handeling a 100 meter rope is a bit difficult, and as it is pulled, stretches proportion - ately with the amount of pull. This was extremely time consuming and didn't give us what we wanted ; straight lines. We then cut the rope down to 30 m and although this still didn't give us straight lines and a good 6 x 6 spacing, we accepted the error and continued to finish parcel A by this method. We continued using the rope well into parcel B. However, by this time, it was into July, planting time was passing quickly, and the millet was simply too

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tall to move a 30 m. rope through. We were forced to use a simpler more efficient method. We then tried having the workers space the 6 meter distance. The only problem we had was in the millet fields, where the workers often wandered away from each other, making a big gap between lines, or they would converge on each other, sometimes even crossing lines. I then noticed the furrows in the millet fields are approximately 1 meter apart and follow parallel to one another. I positioned a worker at every 6th furrow and instructed them to simply pace along this furrow to the end of the fiel where they could then see again. This worked quite well and eliminated most workers from wandering and creating ridiculously large gaps .between lines.

The pace method for our project didn't give us a concistent 6 x 6 m. spacing, but we were able to plant a tremendously large number of seeds in a relatively short time. Considering the short 2 month planting period and the 1300 hectars we will be planting next year, this pace method is certainly the most realistic and efficient for our project.

C. Planting

The rônier seeds we planted were gathered from and around the areas we were planting. Finding the large number of seeds needed was do problem, as the mature female trees were producing large quantities of seeds. Fruits will mature year-round, but the majority can be found during the rainy season.

The fruit is a large ovoid drupe (15x12 cm)and contains 1-3 embryos, so we had to separate the seeds from most every fruit. They would be gathered by a truck and dumped into a large pile where 2-4 workers would simply beat the mature fruit with a stick and separate the seeds from the fibrous fleshy mesocarpe. From here the workers would fill their baskets with seeds and continue to the worksite not far away. To direct plant a line of seeds requires 2 workers . The first would dig a shallow 10-20 cm. hole with a local cultivating tool at each piquet. He would continue on, and the second man with the basket of seeds would drop a seed in the hole, mesocarpe facing down and cover the seed with soil. The process is fast and simple, and we planted the 600 hectares between 3 July and 18 August.

Germination of the seeds took place within several days in the low moist soil, but of course in higher areas where the soil was not as moist germination took 1-2 weeks. There was not time to take data on percent germinated, as this will have to wait until the first leaves begin to appear 6 -7 months after germination.

D. Fencing the Plantation

At this time we are digging the holes for the fence posts in parcel B. We are only able to go as far as securing the posts in the ground because the barbed wire has not arrived yet. We are using rônier posts that have been cut from the local area, and when materials arrive, the fence will be 5 strand barbed wire. To secure the posts well into the sandy soil, we have gathered large quantities of rocks from the plateau, and will place several rocks around the base of each post. We will also be treating the base of each ronier post with the chemical, Lindane , to control termites and other insects. We had hoped to use Dieldrin, as it is effective for a longer time than Lindane, but it was not available. To properly align the post-holes along great distances, I am using the builders level to align piquets placed about every 30 meters along the line. Immediately

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following me are 3 workers, 2 with a 30 m. rope, and 1 to place piquets at each 6 m. length of the rope, marked by tied knots. They simply stretch the rope between my aligned piquets. Finally, following these 3 workers are the rest, of the crew, who are digging the post-holes at every piquet.

Initial reaction by villagers to the fencing of such a large area was negative. With many of their fields found within the limits of the plantation they feared the fence would completely block the trails leading into their fields. However, we will not be blocking these trails. The fence will not extend across trails that are used regularly and are not just temporary.

E. Firelanes

The areas in and around the plantations in the Dallol are extremly dense with tall annual grasses. These grasses propose an annual problem with bush fires burning virtually uncontrolled through most parts of the Dallol in the dry season. Young rônier will most likely not die from these surface fires, but the new growth will be burned, and the emergence of the trunk from the soil could be retarded as much as 10 years. For this reason we are cultivating a 15 m. firelane around the perimeter of each plantation. All grasses are cultivated with local cultuvating hoes, and all shrubs are removed as well. The dried material is then raked together and burned in the firelane, with only large trees and exposed sand remaining. In cases where a farmers field extends across the firelane, we continue cultivating on the other side, as the crops will be harvested leaving a good cleared area. This 15 m. width is considered minimum, and in many areas where the grass is very tall and fire danger is extreme, I have enlarged the firelane to 20 m.

The barbed wire fence was initially intended to be constructed along the inner side of the firelane, thus protecting the fence itself from being destroyed from bush fires. However, a recent decision by the project director and a representative from the financing corporation, has determined that the fence will be constructed along the outer edge of the firelane. Considering we are using rônier and not metal posts, this decision could cause considerable damage to the fence, and a loss of funds to replace burned sections of fence every year. Perhaps next year after we have been through a season of bush fires, and have evaluated the potential damage that these fires can cause, it is hopeful a more wise decision will be made regarding the placement of the fence.

Rônier Exploitation

This year, 5000 mature male rôniers will be marked for exploitation in the Dallol. These trees will be marked with red paint, at the base, for easy identification later, by forest guards. This number of 5000 was estimated by direct counting of rônier in the Dallol and future estimates will also be based on direct counting. The trees will be cut from specific "zones of exploitation" that have been determined by density and number of mature males present. Female, trees may also be cut, but only when they are old and no longer producing fruit, or occasionally when no mature males are present in a dense stand of females. The latter to facilitate transportation of the wood to local villages.

Being a protected species in Niger requires that a cutting permit be issued before a tree can be removed. Rônier permits cost 600 CFA per tree and are issued by the Eaux et Forêts Chef d'Arrondissement after 1 November. The

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Chef continues to issue cutting permits until the specified number of trees to be cut for the year has been reached. The permit is then issued and the cutting is supervised by an employee of Eaux et Forêts to insure the proper number of trees have been cut.

It is hopeful that there will be brigade of men formed whose responsibility would be solely the supervision of rônier removal. The primary benefit of having such a brigade would be a greater control, by Eaux et Forêts, over the remarkable extent of illegal exploitation that occurs in the Dallol . Enormous amounts of rônier are annually removed by individuals who have not been issued a permit to cut. At this time it is very difficult for the forest guards, working in the Dallol, to control such a large area properly. A larger work force for forest protection against such illegal practices would better insure proper management techniques to be successful.

CONCLUSIONS

The Rôneraie project got off to a late start this year, and we are really just coming to grips with the magnitude of this project. We are behind schedule with only 600 of the required 900 hectares planed. Procedural and administrative problems kept us from meeting our 900 hectares requirement.

However, problems of this sort are common as a new project is undertaken, and now we have a great deal of valuable experience behind us as well as time, to accomplish next years 1300 hectar requirement. Workers will be paid regularly, equipment and procedure has been refined to be more efficient, (especially the piquetage) and we will not have to push the equivalent of 12 months work into a 6 month period. At this time we still have a great deal of work to do on the fence around the plantations, and we wi will be learning new ways and means of improving the work for the coming years. Also in a years time definite conclusions on the success of germination can be made on this years plantings.

VILLAGE NURSERIES - KONGOUSSI 1978

by

Mary Young

Peace Corps - Upper Volta

October 1978

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VILLAGE NURSERIES

KONGOUSSI 1978

7 pilot village nurseries were started in July/August 1978 in the Kongoussi/Tikare region of Upper Volta. Sites were chosen by the Eaux et Forêts forester of Tikare and the CRD agents and the PCV in Kongoussi. The reasons for starting nurseries were varied hoping to alleviate some of the problems and improve the success rate of village reforestation projects.

Working with CRD personnel the PCV representing the Eaux et Forêts set up two village nurseries in the Kongoussi region. The forester in Tikare established five working directly with village groups. For each nursery in the Tikare region, Catholic Relief Services donated one 25 meter roll of fencing, one wheelbarrow, one watering can, one shovel, and $\frac{1}{4}$ sack of cement. The villagers supplied the labor, fertilizer, and posts. The neem and cassia seeds were collected by the Eaux et Forêts nursery personnel; neere seeds donated by the villagers or bought in the markets. The Tikare E et F agent and the PCV designed a 3 seed bed plan- each seed bed being six meters by one meter with 50 cetimeters between each bed and the fencing. The two villages the PCV worked with did not receive the same CRS aid. Youginini received a 25 meter roll of fencing leftover from the Kongoussi nursery fence and used the same 3 seed bed plan. At the Tangaye rural school the formateur supplied his own fencing preparing six-four by one meter seed beds. However he did receive an old barrel leftover from a Kongoussi reforestation project to help transport water from the lake-their year round water supply. The labor, posts, and fertilizer were supplied by the villagers/students and the seeds from the Kongoussi nursery and market.

The site for each nursery was chosen in Tikare by the forestry agent and in Kongoussi by the PCV and the CRD agents. The nursery was to be as close to the water supply as possible to facilitate watering. At their respective nurseries the Tikare forestor and the CRD agent and PCV supervised and explained every step in establishing the nursery-layout, picketing, fencing, bed preparation, etc. Each bed was worked with dabas mixing in manure and/or compost. The seed beds were planted in late July/early August for two reasons. Neem and cassia seeds mature during those months and can be collected and planted immediately eliminating the need for storage. Also, appropriate sized seedlings will be produced for the planting season next year. None of the seeds received any treatment before sowing. Seeds were sown in lines 25 cm apart perpendicular to the length of the bed. After covering the seeds with grass the beds were kept moist, watered if the rains were not sufficient. Approximately one month after sowing the seedlings were thinned to 5 cm spacing.

Basic maintenance of the seed beds is necessary between the time of the thinning and the planting season. Beds are weeded and soil worked as needed and seedlings watered two times a week. The trees should be ready at the beginning of June and planted as soon as possible. After the planting season the beds will be cleared, reworked, and revived with compost/manure

and prepared for sowing in early August. The Tikare forestor and the CRD personnel will supervise the continuation of their respective nurseries.

The reasons for starting village nurseries were varied. I-The two Eaux et Forêts nurseries have been unable to satisfy the yearly demands in the region. They supply an area with a radiusof appr. 45 kms. with Neem and Cassia seedlings. 2-Bicycles are the usual transporting vehicules and distances from village to nursery are sometimes greater than 45 kms. The transporting is a problem because even if the seedlings are handled properly in the nursery and on arrival at the plantation site and the roots adequately protected from drying out, the tens of kilometers bumping along on dirt paths negatively affect the seedlings chances of survival. 3-That the tree will be planted the same day it is picked up at the nursery is not assured. 4-Lack of maintenance has always been a main reason for the failure in a reforestation plantation project. The basic maintenance requirements-fencing, termite control, watering-are seldom met.

Village nurseries may be able to solve these problems and assure a better success rate in the village plantations. I-The 3-bed plan can produce nearly 1200 seedlings each year fulfilling the average annual village demand. This diminishes the demands made on the central nurseries and they can now concentrate on local species and fruit trees which require more attention and special materials-plastic pots, pulverisateurs, etc. 2&3-Transporting of trees from the nursery to the site has been reduced to a minimum and same day planting is assured. 4-The survival of the trees the villagers have raised for almost a year may become more important to them. Importance of maintenance of seedlings in the nursery for the past year has been clearly illustrated to the villagers. The equally important maintenance of the trees after plantation is clear and more apt to be followed.

CRD rural schools and villages with established CRD groups active in reforestation would be good locations for future village nurseries. Each village/School would be supervised by the CRD agent living in the village and the Eaux et Forêts agent for the region. Though active only 10 months of the year, the CRD rural schools re-equipped with a year round water supply and various working materials. Children power and energy are channelled by the formateur through their various projects. In establishing a nursery with the students they learn reforestation from step one and are able to carry it through full cycle. With the CRD groups sometimes the whole village is active and one member assigned to organise and supervise the village's reforestation projects. The limitingfactor this past year was finding a year round water supply, which is essential, for each village that wanted to do a nursery.

MARY YOUNG

THE YEGELALAN SAND DUNE STABILIZATION PROJECT

A REPORT AFTER THE FIRST YEAR

Gabriel Tucker
Peace Corps/Niger
October 1978

INTRODUCTION

The Yegelalan Sand Dune Stabilization project, which is funded by CARE began actual field work in the fall of 1977 and is presently one year old. The object of this report is to describe the progress and some of the experience that was gained in the initial year of work. The financial arrangements are not dealt with.

The town and the valley of Yegelalan are located in the Arrondissement of Bouza at approximately 16° latitude and in the 350 mm rainfall zone. The site of this year's plantation, which is actually closest to the village of Asarou, is on a 2 km long system of dunes which sits on the edge of the valley and is constantly pouring sand into the marsh below therefore increasing the relative depth to the water table and making it less valuable for the production of cash crops.

In talking with locals one can quickly find out that the families in the town of Asarou and to some extent Yegelalan, originated in the town of Djibie on higher ground to the west. About thirty years ago families started moving in seasonally and then permanently to exploit the marshy areas for cash crops (mostly sugar cane and manioc.) The people did well with the cash crops in the lowlands but always had to turn to the marginal sandy hills to grow millet. In doing so they had to compete with the herders that once dominated the area and worked out of the old livestock trading center of Tabokaki (see map).

Today many of the hills that should be left fallow or to grazing, are covered with drifting sand and still cultivated every year. Desertification is a serious problem.

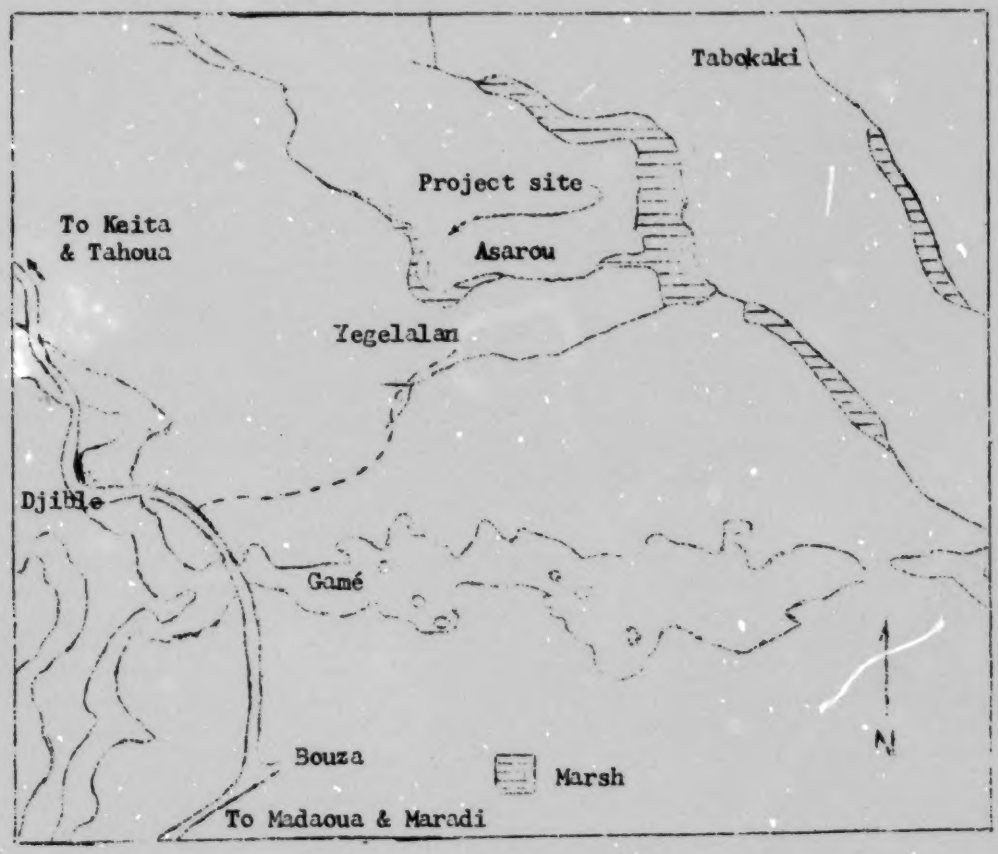
THE NURSERY

The first part of the project was to set up a nursery in the valley directly adjacent to the spot picked for that year's plantation. The area was fenced off and 3 shallow (3 to 9 m.) wells were dug using sheet metal material from old oil drums (200 l capacity) as shoring. This is a relatively easy, inexpensive way of constructing a shallow well and in our case of using temporary nurseries (moved each year) it was found most desirable. Using workers and one head nuseryman, 33,000 seedlings were raised in plastic pots between the months of November and July. The species were Eucalyptus camaldulensis, Prosopis juliflora, Acacia senegal, Parkinsonia aculeata and Tamarix articulata.

T. articulata was propagated by cuttings about 10 cm. long and between 0.75 & 2.0 cm in diameter (i.e between the size of a finger and a pencil) (FAO 1979).

E. camaldulensis was directly seeded into the pots using a needle or large thorn (Weber 1977) and, after the pots were topped with a 1-2 cm. mulch of millet chaff, they were watered with regular watering cans. After germination, plants were thinned down to one per pot and some transplanted to those pots with none. This method was found to give good results and was far simpler than the standard Nobila method which uses seed beds for germination and then transplanting small seedlings to individual pots.

All other species were raised by standard procedure for potted stock (Weber 1977).



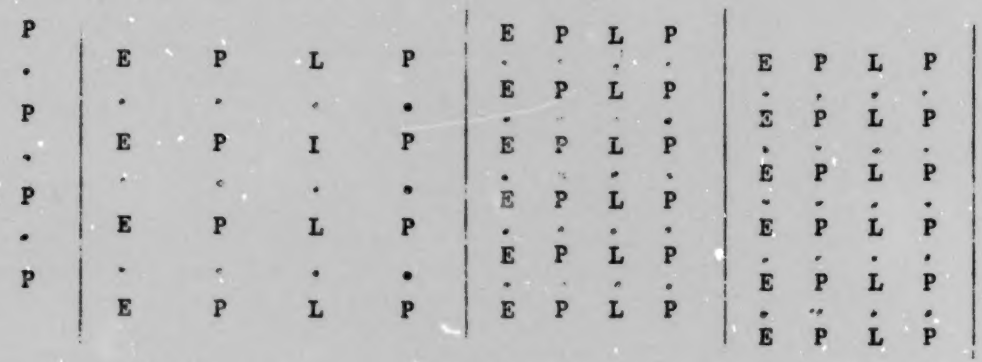
Map : Area around Yegelalan

MILLET STALK PALISADES

During the months of March, April and May, palisades of millet stalk wind breaks were set up on the dune to temporarily stabilize the dunes and to give the seedlings about a year of protection from winds which would otherwise quickly dessicate and erode the sand out from under the seedlings.

The seasonal monsoon and harmattan winds blow generally from the west-south-west and east-north-east respectively (Wilson 1971). The latter pushes sands into the valley every day season and the former, less strong of the two, pushes the dunes back every rainy season. Because of the wind direction, the dunes are almost perfectly oriented north-south. Hence to oppose the prevailing winds, the palisades were also oriented north-south, i.e. along the long axis of the dunes and perpendicular to the winds. On top of the dunes, the lines diverged from due north-south orientation and were contoured to parallel the curved brink of the dune.

The spacing between palisades and whether or not to put in crossing sections, i.e. a checkerboard pattern, is one of the most interesting questions in sand dune fixation. The object is obviously to find the most efficient system, given the wind conditions on the erodability of the terrain. Because in this case the winds generally blow from opposite directions, parallel palisades were considered sufficient. On the top and on the leeward face of the dunes, where the terrain is made up of steep exposed slopes of fine grain sand, the palisades were spaced 8 meters apart. However, on the windward slope leading



E Eucalyptus camaldulensis

P Prosopis juliflora

L Local species (Acacia senegal, Tamarix articulata)

. Interplanting

Figure : Planting Scheme on the Sand Dune

up to the dunes, where slopes are far less severe and sand particles much coarser and therefore less susceptable to wind erosion, a wider spacing of 12 meters was used.

The lines were surveyed in, using a Silva Ranger hand compass and a 50 m tape. On top of the dunes the contoured lines were marked out using a 20 m tape.

All the labor was provided by local villagers a different village working each day of the 5 day work week. In all it took 55 work days for an average of 48 villagers per day to put up 11.2 kms of millet stalk palisades which protected a 10.9 hectare plantation. A total of 13,251 bundles of millet stakls were used. This cones to 0.89 meters of wind break per bundle of stalks, which will be an important number when it cones time to decide how many seedlings to raise in the nursery for a given size dune plantation which is limited by the number of bundles of stalks available.

PLANTING

The out planting of seedlings from the nursery took place during the last two weeks of July. On the most active areas on the top and on the leeward face of the dunes a 2 m x 2 m. arrangement of trees was planted in the 8 m wide strips between palisades. On the less active areas behind the dune on the wind ward side, a 3 m x 3 m. spacing was planted in the 12 m strips between the palisades. That is, in each case there were 4 rows of trees planted between the palisades.

A mixed association of species was considered most desirable. Hence on the most downhill lines the tall fast growing E. camaldulensis was planted to lower the velocity of winds coming from a higher altitude and to protect adjacent high ground. Moving up hill the next line was P. juliflora, a species which grows on dunes as a spreading shrub, ideal for countering the most damaging winds that are within a meter of the soil surface. The next line was of a local species either A. senegal on T. articulata, and the last line was a repeat of P. juliflora. P. aculata, a species which has had limited success on other dune plantations, was to some extent planted as an alternative to the local species. Due to a shortage of millet stalks for making palisades, the size of the plantation had to be reduced, which resulted in an excess of trees. Trees were hence interplanted in the rows, doubling the number of planting spots. The practice is of questionable merit due to the possibility of overstocking but may prove valuable if seedling mortality is high.

The actual marking out of the planting spots was done by pacing, which proved quite adequate by using the surveyed palisades as a guideline.

The bulk of the transportation of seedlings was done with the project vehicle, a Saviem TP 3, which can carry 500 seedlings without stacking.

The nursery workers did most of the planting with significant volunteer help from young boys. The predigging of holes in the friable sandy soil was not necessary and infact undesirable due to water loss by dessication. Compared to previous experience with planting wind breaks in agricultural land, the planting of the dunes went very fast.

PROTECTION

Aside from a live fence of P. juliflora planted along the only path passing through the plantation, protection against browsing livestock was completely left up to 2 guards working from sunrise to sunset seven days a week. Previous experience with other CARE projects handled this way has proved successful if responsible guards could be found. This method of protection is even more desirable if compared to the only other alternative for such a large plantation, i.e. five strand barbed wire fencing, which has never been successful in stopping goats and which often ends up being an excuse for for lax work on the part of the guards.

In the end though the best and only real protection is the cooperation of local villagers and herders.

CONCLUSION

For the upcoming year perhaps the most important place for improving metodology is in the planning of the number of trees raised in the nursery based on the available millet stalks to protect them. In doing so, overstocking and the needless waste. of time and money can hopefully be avoided.

There is little doubt that the technology is there to stabilize sand dunes in the African Sahel. The question is not so much how to fix or stabilize dunes but more important, why are they there and how can the man-made desertifying pressures on the ecosystem be eliminated.

REFERENCES

FAO (1974) Tree planting practices in African Savannas. FAO Forestry Development Paper No 19 Rome 185 pp.

Weber, F.R. (1977) Reforestation in arid lands. Action/Peace Corps Program & Training Journal, Manval Series No 5.

Wilson, I.G. (1971) Desert sand flow basins and a model for development of ergs. Geogr. Journal, 137. 1971 P. 180-199

ACACIA ALBIDA PROJECT

C.A.R.E./ CHAD

October 1978

By Steve Riese
Peace Corps/Chad

INTRODUCTION

In the Sahel, the farmers land is the basis of his country's live - lihood. Food, fuel and shelter come from the land. The rural economy is based upon the surplus harvested from the land.

At present, the Sahelian farmers face a very real paradox. On the one hand, they have adequate quantities of soil, sun and rainfall; on the other, they are faced with erratic rainfall distribution, intense sun and wind, and increasing pressure to produce more from a given amount of land. When the above conditions are coupled with an outmoded system of land-use, the farmer finds himself in a marginal position with very little hope of improvement. Furthermore, modern agriculture is based on the wide use of chemical fertilizers which remain too expensive for sub-sistence farmers.

To help ameliorate the deteriorating situation, CARE, at the request of the Chadian Government, has planned and implemented the Acacia Albida Project, a farmland restoration program. The hub of the project is the establishment of stands of the Acacia albida tree in the grain fields of the farmers. This tree has a reverse deciduous cycle whereby it defoliates at the onset of the planting season. The land can be planted in grain while receiving year-round vegetative cover from the harsh Sahelian elements. Furthermore, the plans which are grown under the crown of the Acacia albida are generally superior to the plants grown in the open (Studies of fields populated by the Acacia albida point to an average increase in grain production of 15% as compared to bare fields). These fields with stands of Acacia albida generally require little or no fal - lowing. This is in contrast to open fields which require fallowing in at least one year in two; or worse, many fields are cropped until rendered useless. Thus through the establishment of stands of the Acacia albida tree, farmland, the country's essential capital is expanded.

To complement the Acacia albida plantings, the project includes two other components :

a) village tree plantings will protect the land and the people from the elements and will provide fuel and construction materials.

b) establishment of live fences will allow the farmer and the gardener the basic means to protect and control his land and crops against damage from animals.

THE MAIN GOAL

The main goal of the project is that farmers become interested in the establishment and protection of trees. As broadly stated in the introduction, trees are a vital renewable resource of the Sahel and their presence is a vital necessity of the future of the Sahel. To accomplish this goal the project employs four basic methodologies: a) simple techniques, b) short - term encouragements, c) high field presence, and d) graphic presentations.

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The techniques must respect the land-use patterns of Sahelian farmland as well as the technical difficulties of decentralized plantings. The field trees (Acacia albida and some live-fencing) individual fences are used. These types of fences allow people to use traditional paths as well as to allow animals where the volunteer farmers do not have contiguous fields, individual fencing is more economic.

Sahelian farmers are like any farmer in the world; they are not going to invest time and energy in something which will not pay-out within a year or two unless they receive some aid. The live-fencing component is a short-term-payout investment of energy as attested to by the small farmers requesting live-fence species to protect their fields and gardens. However, the establishment of the Acacia albida is an investment of energy on a long term payout which may never directly benefit the farmer who plants the tree. A dense population of trees (80ha) might begin to benefit the field in eight to ten years (by this time, the field is being cropped by another farmer or has gone back into the fallow cycle). Thus, the establishment of the Acacia albida is really a Public Works effort that is necessary for the community but may never benefit the original planter and protector. For this reason, the Accacia albida project has subsidized the efforts of the farmer with a food-for-work component. Besides encouraging farmers to plant trees which are a benefit to the community in general, this food supplements a depleted food stock which is generally under stress during the high energy requirement of the farming season.

High field presence of all project personnel is a basic target of the project. To farmers who have gotten along for centuries without planting or protecting trees, a strong extension program is required to reinforce the notion that tree planting is a vital Sahelian activity. On the other hand, the farmer is not going to be interested if the project personnel do not show interest. Fortunately, the Chadian Forestry Service has appointed 14 dynamic agents to participate in the Acacia albida project. These agents are assisted by five Peace Corps Volunteers and numerous village extension aids. These 14 agents guide the planting activity of over 2,000 farmers and are active in the education of many more. Any success of this project is heavily dependent upon the hard work and dedication of these people. The project provides each agent and volunteer with a mobylette. Many of the village aides have bicycles.

The project would be a failure if some interest in planting trees was not generating amongst the farmers. In the course of thethree years of the project, the best 'salesmen' of the concepts of the project has been the agents and the farmers themselves. In the last year, the results of some phases of the project has attracted the attention of farmers. Movies are being taken and shown back to the farmers. These movies allow the farmers and the agents to articulate the reasons for planting and protecting trees. The results of this medium are yet being weighed, but it is one way to call relevant attention to the need of tree planting in the Sahel.

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Implementation activities

There are currently 9 field nurseries producing an annual total of about 300,000 seedlings. These seedlings are planted-out by over 2,000 farmers and their families. The trees are moved out into the field in early July for planting during the period of mid-July to mid-August. Al - though some work has been done on irrigating planted trees, the planting dates generally depend upon the timing and quantity of rains.

The Acacia albida seedlings are protected by individual fences made up of stakes and thorns. The stakes and thorns are treated against termites with crankcase oil and anti-termite chemicals.

The seedlings themselves are attacked by caterpillars, spiders, domestic animals and elephants. The insects are treated with HCH, the domestic animals are deterred to some degree by the individual fences. The elephants remain a problem in some areas. Anti-deer spray seems to to have helped and cattle blood will be tried this year.

Several methods of planting the trees have been tried with the result still inconclusive. The "best" system seems to be a function of climatic and logistic problems.

Direct seeding has been successful to some degree in at least one area, but it may require some dry season irrigation. However, even with irrigation, direct seeding may result in much lower capital costs such as transport and nur ery expenses.

Large scale establishment of Comiphors as live-fencing is being tried in the northern zone (400 isohyete). If this is successful, large scale live-fence operations could take place from cuttings of Comiphora.

Excellent take and development of Acacia albida seedlings has been experienced in the 850 mm isohyete area. This is due to superior nursery stock (4 mo.) and timely planting of seedlings. Many of these seedlings are over a meter after one growing season.

Farmers must show a certain degree of initiative to remain in the project.

However, with the goal to educate so many farmers as possible in the planting of trees, most farmers are given the benefit of the doubt. In the 600 mm isohyete zone, two to three week droughts during July and August have been experienced, in every season. In cases like this, those farmers having very low take rate but wanting to remain in the project are allowed to do so. Furthermore , the decentralized nature of the project means that some farmers receive less than satisfactory surveillance. The solution to this problem is not to eliminate the farmer but rather to privide better educational tools such as training films and better trained village aides.

The project is funded through 1979. However, it is hoped that recogni- tion of the importance of forestry in the Sahel will allow continuation of this project or a project similar to it whereby the farmer will participate in the planting of trees. Four years is enough time to establish tree plant - ings but not enough time to ingrain the notion in small farmers that trees

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must be planted and protected. In short, if the Sahel is to be reforested, the small farmer will play an important part.

Other Problems

Farmers were very suspicious in the beginning. They heard that the government would abscond their land once the trees came to term. Through the constant presence of the forestry agents, the farmers have undestood that this is not so.

The fear of birds also caused problems. The fact that trees provide homes for birds make some farmers hesitate before planting trees. The bird problem will one day be solved, but if the Sahel is to continue to be fertile, it cannot be solved at the expense of Sahelian trees.

A final Word

If the Sahel is to remain hospitable, trees must be propagated and protected. Modern Technology has not yet found solutions to the problems faced by the subsistence farmer who cannot pay for fertilizers and insecticides. The litter of trees and grasses provide the bulk of plant nutritients returned to the topsoil every year. This source is renewable and costs only what the farmer pays out in energy to propagate and protect it. The lesson of the value of protecting this renewable source of nutrients is quite evident to one travelling in the Sahel : where trees, especially Acacia albida, are protected by the local po - pulation, the ground is continually fertile; where all trees have dis- sapeared, so has the producing part of the soil.

Fuel is provided by wood— this is also a renewable resource is required if it is not to dissapear altogether. The one big alternative to wood as fuel is dung. When the wife and the farmer start disputing the use of dung, the area has indeed been improverished.

C A R E C H A D

A C A C I A A L B I D A

PROJECT :

M A I L A O S T A T I O N

by

Dan SLACK

Peace Corps/Chad

October 1978

PERSONAL WORK

I am assigned to the Maflao zone of the CARE/CHAD Acacia Albida project. Maflao is a fair sized village, of approximately 700 persons, located seventy kilometers south of N'Djamena and it contains one of the larger CARE/CHAD nurseries. Since my arrival in April, my time has been split between nursery work and field operations.

At first, most of my time was spent in the nursery organizing and giving technical assistance. I worked at the same level as the existing Chef de la Pépinière. Together, we prepared the 120,000 seedling capacity nursery for the approaching planting season. In this context, my work involved : seed germination techniques, preparation of watering schedules, organization of workers, and organization of work in "tâche" (or task) systems. By the arrival of the planting season, we had the following composition of seedlings :

	Number of seedlings
Acacia albida	70.000
Parkinsonia spp.	40.000
Azadirachta indica	3.500
Prosipis spp.	2.500
Albezzia lebeck	2.000
Eucalyptus spp.	500
Khaya senegalensis	500

The second phase of my work in Maflao involves organizational, supervisional and technical assistance with field operations. Here, I work directly with the "surveillants" for each village. I work in two zones which serve, in total, 25 villages; each zone being under the supervision of one Eaux er Forêts agent. This season, the "surveillants" and I listed participating farmers with certain specifics on each farmer, such as : first, second or third year participant, operations completed for this season, number of trees living in field, number to replant or number to be furnished. We also did much work together on preparing the villages for the arrival of the potted seedlings. This included (firstly) the location and construction of small holding nurseries (pépinières intermédiaires) in each village. It was also necessary at this point to locate and develop a water supply for the nurseries. Usually we chose a nearby depression that was known to hold water and then deepened and protected it. This water, received from the intermittant rains that come before the onset of the real rainy season, served to water seedlings before, during and after outplanting. At the same time, we encouraged the farmers to better prepare their fields for planting, by digging small basins and adding herring bone dykes (arêtes de poisson) to trap more efficiently run-off water. The idea of the small dykes didn't come accross too well, but we hope that the farmers will notice the benefit derived from those that were done properly.

During the actual planting, our work involved much demonstration on planting techniques and organization of village workers into teams to maximize use of time and materials. Lastly, I have been involved in the direct sowing portion of our program. As our zealous agents had over recruited for this year, we were forced to do some direct sowing in practically every village. Farmers chosen to do the "semis-direct" were generally the one with the most inaccessible fields. After designating who was going to be included, we then proceeded to give demonstrations and handout seeds. Each site was to be sown with three clipped Acacia albida seeds (for fast germination). We asked for the same site preparation; i.e. dug-out basin with herring-bone dykes. As soon as the real rainy season began, about the 18th of July, the operation started. Results have been mixed. We found the best period for sowing occured during the last two weeks of July; a period which was marked by heavy daily rains. The seeds sown at the very beginning of this period faired the best achieving heights of twenty centimeters by the first week in September. As the direct sowing operation was late in getting started, organization and implementation were not optimal. Many villages were late in receiving seeds and often seed quality was low. When considering the number of holes sown, the average survival rate throughout the villages is about 30%. Several villages were exceptioanl, however, having survival rates of sixty to eightly per cent. The factors that combined for the great success in these villages were : good seed, early distribution, good timing in sowing and genuine interest and enthusiasm on the part of the farmers.

As this season finishes, my work continues in the area of field operations. I imagine that next year, my work will be relatively similar except in the nursery where I will take a much more indirect role.

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DOUGUI FORESTRY PROJECT :

REFORESTATION THROUGH PROTECTION

OF NATURAL REGENERATION

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Chun K. Lai
Peace Corps/Chad
October 1978

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INTRODUCTION

During the past decade, there has been a continuing process of deforestation in the region north of N'Djamena, capital of Chad. This process may be attributed to several factors. The steady population growith of N'Djamena has increased the demand for firewood, charcoal, and construction wood. Furthermore, many of the traditional herding and agricultural practices are destructive to the woody vegetation of the area. Herders often lop trees to provide their livestock with fodder and trees suffer directly from open-range livestock grazing. The clearing of wooded areas for agricultural fields and the accidental spreading of fire from millet fields to adjacent woodlots have further deforested the area.

These parameters, along with a prolonged drought, have caused a steady rate of soil deterioration, soil erosion by wind and rain, compaction and cracking of upper clay horizons, and mineral depletion. The effects are a lower soil fertility and a poorer site productvity, which further tax the already marginal and fragile ecosystem.

In an effort to remedy this ailing situation, a project was designed and started in 1976 by the United Nations Food and Agriculture Organisation (FAO), in collaboration with the Chadian Foresty Service. This project, CHD/75/013, is titled "The management and exploitation of forest vegetation in the area around N'Djamena, Chad".

SCOPE OF PROJECT

Funding : the project was conceived largely through the work of Mr. Joseph Parkin, a FAO Forester from Switzerland. He was the project director from its onset in April, 1976 until March, 1978. The original project document states that the project will operate over a five year period with the following financial contributions :

$ 1,235,476	from the United Nations Development Program (UNDP)
$ 125,000	from MISEREOR (a German International Aid Organization)
67,000,000 CFA	from the Chadian Government

Goals and Objectives : the long term goal of the project is to halt the widespread, random destruction of the woody vegetation in this region and to institute a rational system of management, utilization and exploitation of these forest resources, ultimately, to introduce a sensible land-use plan. To achieve this goal, the following objectives must be implemented : 1) introduction of a reforestation technique which is adapted to the ecological conditions of the area and the socio-economic conditions of the local population. 2) protection of approximately 3500 ha. of naturally regenerated forest vegetation through a network of protected woodlots, or "parcelles", 3) application of intermediate treatments such as semi-direct seeding and planting to increase the stocking of the "parcelles", 4) inventory and sampling of the "parcelles" in order to develop management plans aimed at maximizing the productivity, regulating the harvest, and improving the utilization and exploitation of the wood resources, 5) training of Chadian Forestry Agents in methods of natural regeneration and protection, and in the use of surveying, topographic, and mensuration instruments in the field.

Personal and Equipment : the project is based in an office house on Avenue El Numeiry in N'Djamena. The staff includes two FAO personnel - Robert Langley (Director) and Joseph Gravage (Foresty Expert), two Chadian Forestry Agents - Djendeye M'Bainda and M'Batta Darnace, four Peace Corps Volunteers - Chun Lai, Forester (Mapping), Charles Marcus, Pam Pomfret, and Ray Stewart (Foresters), a secretary ; two chauffeurs, a forest technician stationed at the village of Dougui Touboubou, and "pointeurs", or work supervisors, and workers - the number of whom vary according to the quantity of work in progress.

Project equipment includes the following : a Toyota Landcruiser, two Peugeot 404, a Renault R12, a Renault R4, a Berliet, two Renault trastors, a Mobylette, assorted surveying, topographic, and mensuration instruments, various office equipment, assorted handtools and other miscellaneous equipment and tools.

DESCRIPTION OF PROJECT ZONE

The project zone is located in the general vicinity of the Dougui Experimental Farm, which is about 50 km, north of N'Djamena. The zone is estimated to encompass about 32,000 ha. situated south of the paved road between Djermafa and Massaguet.

This sparsely populated area is characterized generally by deep, sandy soils, with black, clayey soil prevalent in the low, wet places. The villagers are homogeniously muslims, speaking Chadian Arabic and engaging themselves in livestock herding, mainly cattle, goats and sheep, farming - mainly millet, and firewood and charcoal production. The following is an estimation of the breakdown of different land uses as a function of the total land area within the project zone :

Traditional agriculture	34%	
Forest pasture land	30%	
Open-range pasture land	12%	
Forest under protection	11%	*
Cattle trails and transits	11%	
Other uses	2%	
	100%	

* After completion of the projected 3,500 ha of protected "parcelles".

The vegetation in the project zone can be classed as Sahelian. The principal naturally occuring woody species include : Acacia seyal, A. nilotica, A. senegal, A. Sieberiana, Anogeissus leiocarpus, Balanites aegyptiaca, Bauhinia reticulata, B. rufescens, Boscia senegalensis, Compretum spp., Dichrostachys glomerata, Diospyros mespiliformis, Grewia spp., Guiera senegalensis, Poupartia Birrea, Stereospermum Kunthianum, Tamarindus indica, Ziziphus mauritiaca.

PROTECTION OF "PARCELLES"

The basic procedure in establishing a "parcelle" is as follows : through general reconnaissance, good areas of naturally regenerated forest vegetation are identified and the chief of the village which traditionally owns the land is contacted. If he expresses interest in setting up a "parcelle", negotiations are held to delimit the boundaries of the "parcelle". Upon striking up an agreement, the boundaries are staked out and a "pointeur" is assigned to the village to form and supervise a 30-man work crew from the village population.

The actual protection work consists of building a "zeriba" and clearing out a firebreak. A "zeriba" the arabic word for a thorn branch barrier, is made by piling up thorny branches cut from trees in the firebreak area and further out. A typical "zeriba" is about two meters wide by two meters high and completely encloses the "parcelle", keeping livestock and people out. A firebreak of 20 meters width is cleared exterior of the "zeriba". All flammable plant materials are removed and woody stumps burnt to prevent regeneration in the firebreak area. Following the completion of this work, a guardian - usually the chief of the village - is hired to patrol the "parcelle" in the morning, reinforcing the "zeriba" when and where necessary and making sure that no livestock or people enter the "parcelle".

Payment of Workers : The workers are paid in money from project funds and in food from the World Food Program (WFP). A novice "pointeur" receives 420 FCFA per working day, with periodic raises depending on the quality and duration of his work. A worker is paid 270 FCFA and a guardian 320 FCFA per day. In addition, the following ration of WFP is earned per day. 2 kg of cornmeal or sorghum and 200 g of sardines. Monetary payments are made in the middle and end of the month, the food is distributed at the end of the month.

SURVEYING OF "PARCELLES"

To prepare for the surveying work, cement markers, or "bornes" were put in place on the corners of the firebreak perimeters. Then, by stationing a theodolite, both the Wild TZ and Kern DMKM models were used, over these "bornes", interior angles were turned. Distances between "bornes" were measured by stadia rod sightings or Topofil, a measuring device which employs the movement of string over a calibrated roller mechanism. On this fashion, closed traverses were performed for all 13 parcelles and open-traverses, using hand compass and metal measuring tape also, were ran to interconnect parcelles, villages, major access trails or "pistes", and the paved road.

The surveying information has been converted to rectangular coordinates from which the following surface areas were calculated. The name of the "parcelle" is taken from the village which owns the land and provided the labor for the protection work. For these 13 parcelles, about 41 km of "zeriba" have been built and 44 km of firebreaks cleared.

Parcelle	Surface Area (inhectares)
Kilmi	166.96
Magueta	59.84
Allaha	41.54
Tchiketé	35.08
Touboubou I	36.25
Touboubou II	135.94
Ahondroé	76.14
Lassada	96.19
Djimezé	38.21
Goua	53.73
Ardebé	40.92
Soueté	64.99
Minjelgué	50.70
TOTAL	896.49

Using the rectangular coordinates, the "parcelles", villages major "pistes" and the paved road will be plotted on a map to be drawn at a scale of 1:10,000. A forest vegetation type map for the region has already been developed, using information interpreted from a 1974 aerial photo series. This map at a 1:50,000 scale, classed forest vegetation groups as Acacia, Mosaic - a mixture of several species, or Steppe open terrain, very sparsely wooded.

STAND INVENTORY AND SAMPLING

Thus far, five parcelles - Tchiketé, Touboubou I, Touboubou II, Allaya and Kilmi - have been inventoried. To prepare a parcelle for inventory, a network of section lines, or "layons", and pickets is created. Depending on the size and shape of the parcelle, a base line is chosen from one of the sides of the "seriba". At 100 m. intervals along this base line, a "layon" about 1 m. wide is cleared through the "parcelle" following a compass bearing which is perpendicular to the base line. Along this "layon", a wood picket is driven into the ground at 40 m. intervals. Afterwards, using millimeter graph paper at a scale of 1:1000 (A millimeter = 1 meter) and pacing along the "layons" individual trees and groups of trees are plotted to scale on the graph paper. This provides general information on stand composition and density, and the location of empty spaces which need to be seeded.

To date, only one "parcelle", Tchiketé, has been sampled. Using the stand inventory map of Tchiketé, the empty spaces were noted and the wooded areas, comprising about 25 ha. were divided into 1 ha (100 by 100m) blocks. By employing a random numbers table, five blocks, were selected for sampling, in effect, a 20% sample of the wooded protion of the "parcelle". Each selected block was further divided into $\frac{1}{4}$ ha. (50 x 50 m) sections. Within each section, every map was plotted by number and species on a section map and the following measurements made and recorded : diameter class of tree at 30 centimeter height, and crown diameter - two measurements at right angles. Calipers were used for measuring trunk diameter and stadia rods for crown diameters and height of tree, except for cases where the height exceeded the four meter stadia rod, a Leiss clinometer was used. This sampling method provides detailed information on stand composition and density, crown volume and density, and serves as a base for growth data.

SEMI-DIRECT SEEDING

This past rainy season, about 400 ha of empty and understocked areas withing nine "parcelles" were semi-direct seeded with various species of Acacia, Tamarindus indica, Poupartia birrea and other species. In addition, about 55 ha. of low, swampy land and intermittent streams were seeded with Diospyros mespiliformis.

Most of the seeds were purchased locally from villagers who collected them. Acacia seeds, collected near Tourba, on the edge of Lake Chad, were given to the project by the Chadian Forestry Service. Germination tests were performed on different species of seeds to ascertain the best method of seed treatment - soaking in sulfuric acid or in boiled water, and the optimal soaking time and acid concentration.

Following a favorable rainfall, the seeds were treated according to the test method which gave the best results and brought to the "parcelle" the same

day for semi-direct seeding. The species chosen depended mainly on the type of soil, for example : Acacia Senegal in sandy soils, A. Seyal in intermediate types of soil, and A. Nilocica in black, clayey soils. The procedure for seeding was as follows : a group of three holes, closely spaced together, is made, one seed is placed in each hole and covered with earth. The groups of seeds were spaced three to four meters from each other. In addition, at the Dougui Experimental Farm, bands of windbreaks, 10 and 15 meters wide, were laid out, tractor-plowed, and semi-direct seeded.

NEW PEACE CORPS VOLUNTEERS

This month, three new PCV's joined the Dougui Forestry Project. Pam Pomfret, Ray Stewart and Charles Marcus. Amongst their duties, they will assist in establishing a seedling nursery of 60,000 trees at the village of Allaya, improving the traditional techniques of charcoal production and integrating the forestry and herding practices of the region. They will also assist in the ongoing surveying stand inventory and sampling, and other work.

CONSTRUCTION WORK

Four buildings will be constructed, principally from MISEREOR funds, planned for the village of Dougui Allaya is the construction of a workshop-garage-storage building which will be used for storage and repair of some project vehicles and stockpiling of WFP food, and the principal control post which will have office and living space for Chadian forestry Agents and/or PCV's. Two additional control posts will be built at the villages of Mogueta and Minjelgué. Detailed construction plans and bids from local entrepreneurs have been sent to FAO headquarters in Rome for approval and selection of a contractor.

In addition, two mud-brick, tin roof, cement floor houses will be built for project use at Allaya and Dougui Touboubou. Negotiations are in process with EDAR for the installation of closed-system wells at some of the building sites.

TRAINING OF CHADIAN NATIONALS

Training of Chadian Forestry personnel is achieved through the endowment of scholarships and training in the field. The project has provisions for the granting of two scholarships, each for a duration of two academic years at the Forestry School in Banco, Ivory Coast, to Chadian Forestry Agents who have shown quality work with the project. Currently, Mr. Bardoum, who worked with the project in 1976-77 is enrolled in his second year of study at Banco.

Training in the field is a continual affair involving the exchange of experiences and knowledge. Thus far, the Chadian counterparts have shown good progress in the operation and application of surveying and mensuration instruments. With further training, they can become qualified forestry technicians.

DISCUSSION

This project has taken some positive steps and directions in its first two years. It has introduced an alternative approach to the prevalent method of reforestation in the Sahel - that of planting.

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Protection of natural regeneration through a system of "zeribas" firebreaks and guardians has some distinct advantages. In terms of time, money and labor, establishment of a "parcelle" is less costly per unit area than establishment of a plantation. The technology and equipment involved are on a very basic level, thus permitting the villagers to do all the protection work with their own axes and machetes. When properly installed and maintained, the "zeribas" - firebreaks - guardian system ensures virtually 100% protection against unwarranted cutting, livestock grazing and fire. Protection facilitates the natural regeneration process and contributes to soil and site rehabilitation. Intact "parcelles" are conducive to research, survey and mensuration of the forest vegetation within, eventually providing volume and gowth rate information. In addition, the economy of the local population is given a boost from the money and food earned for protection work.

This putting into reserve of some wooded areas discourages indiscriminate cutting and with proper management and exploitation, will yield many future benefits to the local villagers. Hopefully, this example of conservation will lead the villagers to the important realization that wise land-use is imperative and also highly beneficial in a fragile ecosystem such as the Sahel. Ultimately, that realization is the key to reversing the wanton process of natural resource decimation.

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NOTES FROM THE WORKSHOPS ON DESERTIFICATION

Process of Desertification

The flowchart on the following page is mearly an attempt to diagram some of the more obvious elements in the process of desertification.

From the outset one must agree that desert encrouchment is, for the most part, a manmade phenomenum. Periodic prolonged drought along with other climatic factors, may trigger the situation, but it is the manmade pressures that set up the problem and then prolong it once it is moving.

Over the past years, the increase in services that the people of the Sahel have received from the outside world has to some degree buffered the effect of natural disasters like epidemics and droughts that kept the human population in line with the regions carrying capacity for the species. This situation along with the exclusion or omission of modern birth control methods has resulted in a population which is growing at a largely unrestricted rate and at the same time trying to subsist on very limited marginal land.

To the pastoralist this means that he must increase his herd of animals to feed his larger family and to have enough animals to get through a dry period for he has no alternative form of capital accumulation. On the limited marginal rangeland this has led to overgrazing.

To the sedentary farmer who is increasingly planting cash crops to supplement staple crops, it means he must plant more crops on increasingly scarce land. This in turn leads to competition with the pastoralist for land and unjudicious cultivation due to lack of following.

To the urbanite, who depends indirectly on the pastoralist and the sedentary farmer for food products, it means more directly that increased amounts of firewood must be cut in the area surrounding his town or city to support the growing population. This obviously can lead to deforestation for which there are some very severe examples.

In the end it comes down to the three main destructuve pressures on the ecosystem : overgrazing, deforestation , and unjudicious cultivation practices. The three of which, when combined with various climatic factors such as heavy rains, wind and drought, can only, if left un - checked, lead to devegetation, erosion, and finally to desert.

An important factor in the process of desertification, the lack of fal - lowing is compounded by the nonplanting of deep rooting cover crops or perinnial grasses on those fields which are left fallow, as these grasses can not properly improve a field under extended drought conditions be - cause of poor viability of seeds or the plants inability to mature before the rains end.

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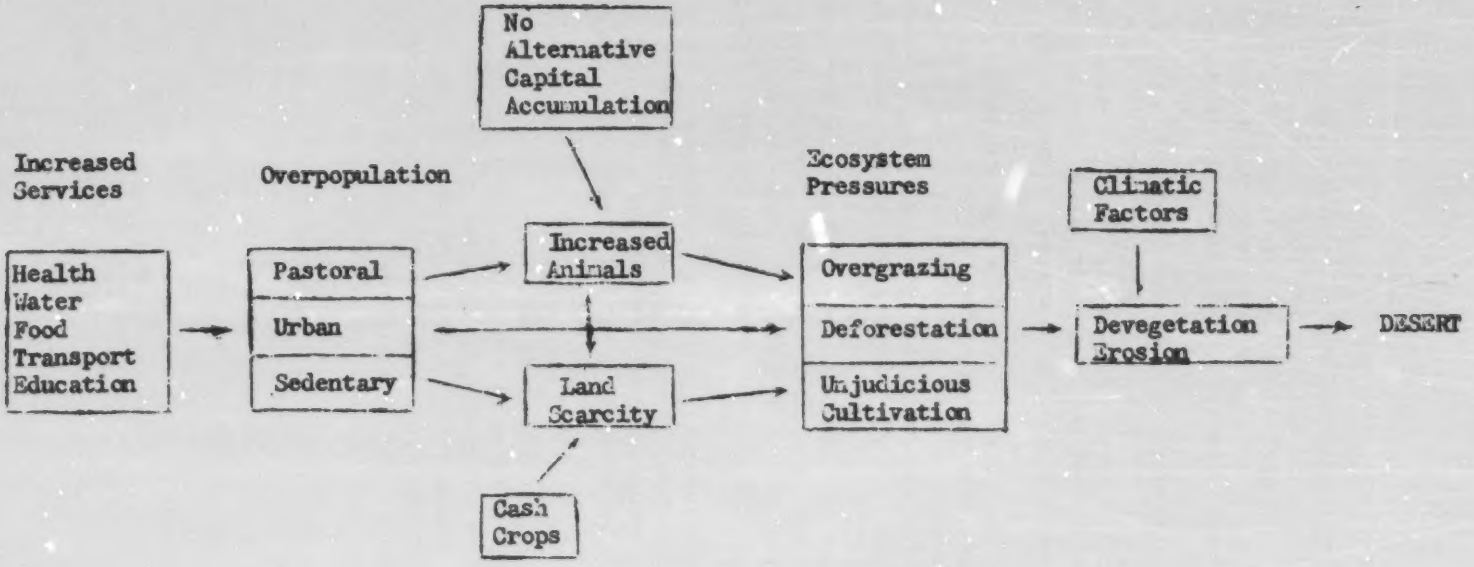
Flowchart: PROCESSES OF DESERTIFICATION



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Many villages under subsistance farming feel they have no choice but to plant as much land as they can even though they think the soil needs to be left fallow. They only see the present and the present is allpressing, furt ermore, in leaving half of their fields fallow there is little doubt that they will not be able to produce enough food for their own subsistance.

Humans have been favored in the ecosystem and when an ecosystem falls apart, normally it is the favored species that suffers most.

With proper education of the people through extension agents, radio and, perhaps in the future, television of the on going process of desertification it is hoped that the people themselves will become receptable to methods and techniques which can aid in the arresting of the process.

Combatting Desertification

Perhaps a future rise in living standards will lead to a voluntary birth control.

Land use planning as apposed to family planning might be much easier to institute (1) because government controls all land, it could be a very powerful tool to combat desertification (2) because there is no private ownership, farmers are less apt to practice good land management on their own . A line across Niger has already been drawn, north of which no cultivation is allowed, it only needs to be enforced.

The technology for combatting desertification is there and proven, but the problem is getting the people to accept that there is a problem and that they have the responsibility to fight it. The great green wall of China was very successful, planting thousands of kilometers of shelterbelts to hold off the Mongolian Desert in North-West China, but organizing the countries of the Sahel or even Niger to mobilize that kind of manpower seems impossible. Game ranching which can yield 14 times the lean meat per acre as opposed to Masi cattle is a proven technology that would be extremely hard to successfully introduce to the nomads (the problem is a social one not purely technological).

Relocation or resettlement of large groups of people on marginal land, it has been done to a large extent already in Somalia. It may be moderatly effective in resting marginal land and give people a better resource base, but it is purely a band aid measure that does not get to the root of the problem. Instead of teaching people to live with their land, caring for it and trying to get the most out of it for the long haul they develop the mentality that they can waste the land away with unwise practises and then move on to new land.

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Basic studies still need to be done to look at firewood supply and demand, to plan where village woodlots should be planted, etc...

Perhaps the best way to combat desertification in a serious way would be a combination of first preventative measures through strong land management and secondly a large scale strategy to institute reconstructive measures like sand dune stabilization and windbreak and shelterbelt systems using satellite photos and what not to sort out those areas that are least susceptable, those that are lost causes, and those that can best benefit and make use of the energy input.

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CONFERENCE RECOMMENDATION

All Peace Corps Volunteer Foresters in the nations represented at the conference are issued the manual Reforestation in Arid Lands, a VITA publication written by Fred R. Weber. The manual is the best piece of information on Sahelian forestry published, a fact we have all had proven time and again. This is great for us, the volunteers; however our counterparts and other host country nationals in our service (Service des Eaux et Forêts) are denied the manual because it has not been translated into French. If anything, these people have a greater need for the manual than we and it was with this in mind that we, the participants of the 1978 Peace Corps Forestry Conference wish to request the immediate translation of the manual Reforestation in Arid Lands into French and the distribution of the manual to our services.

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"1978 Peace Corps Forestry Conference"

October 25-30, 1978

American Cultural Center

Niamey, Niger

Wednesday, October 25

1500 - Introduction

Workshops

1510 - A. Range Problems - Jake Green, Chairman

B. Process of Desertification - Gabe Tucker, Chairman

1640 - A. Work in the Nursery - Tom Shaw, Chairman

B. Combatting Desertification - Steve Seefeldt, Chairman

Thursday, October 26

Opening of Conference

0800 - Welcome, Stephen North, Associate Director of Peace Corps/Niger
Le Capitaine Abdou Daouré Director P.O. des Eaux et Forêts/Niger
Sa présentation, le Rôle du Volontaire dans le Développement Forestier.

Country Presentations

0900 - Niger

0920 - Upper Volta

0940 - Fred Weber, talk on the history of Peace Corps Forestry in Niger.

1215 - LUNCH

Individual Presentations

1600 - Ben Bastyr
Title : Reforestation of Ronier Palm in the Dallol Maouri Region : Niger

1630 - Mary Young
Title : Village Nurseries

1700 - Jake Green
Title : Boundry Layout and the Placement of Bornes around a Forêt Classée (Slide presentation)

1730 - Mike Godfrey
Title : Slide Presentation on the Pastorial Region of Niger.

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Friday, October 27

Workshops

0800 - A. Sand Dunes - Gabe Tucker, Chairman

B. Project Funding - Gary Eilerts, Chairman - Director, Luthren World Relief

0900 - A. Woodlots - Steven Seefeldt, Chairman

B. Getting Community Support - Jack Rollins, Chairman

1000 - A. Windbreaks - Glen Groben, Chairman

B. Role of the Volunteer Forester - Tom Shaw, Chairman

1100 - A. Ronier - Ben Bastyr, Chairman

B. Forest Stratification and Classification - Jeff Towner, Chairman

Field Trips

1300 - Close Conference leave for Park W. Spend night in Park.

Saturday, October 28

All day in Park to study forest ecology. Return to Niamey in the afternoon.

Sunday, October 29

Trip to Keita to see stabilized sand dune at Mayé. Spend night in Keita.

Monday, October 30

Visit sand dune at Yegalélan. Return to Niamey

Some Presentations from the 1977
Peace Corps Forestry Conference

REPORT FROM CHAD FOR THE ARID-LANDS FORESTRY CONFERENCE IN NIAMEY, NIGER 1977

Report on the status of Forestry in Chad 1977

Forestry in Chad is presently far behind the efforts being made in other Sahelienne zone countries. But this does not mean that nothing is being done. Many organizations which provide funding for development in under-developed countries are now beginning to look at Forestry in Chad seriously for the first time. At present, the main interest is in the planting and protection of the Gao (Acacia albida) in areas where intensive agriculture has, over a long period of time, improverished the soil, and reduced the lands capacity to feed its people.

Beginning in 1976, C.A.R.E. Chad started a large - scale planting operation for the Acacia Albida in the region south of N'Djamena. C.A.R.E. 's project involves the participation of the local farmers, who are encouraged to work , planting trees by a regular ration of food which has been contributed by the Unites States. The project built and maintains six tree nurseries in the zone. Each nursery has either a Peace Corps Volunteer or a Chadienne Eaux et Forêts agent who is responsible for the work schedule at each site.

In 1976, 1500 hectares were planted in the first year of the project's operation. With a survival rate determined at the end of the dry season of 40%. In 1977, the second year of the project, the number of hectares planted was increased to 2,500 hectares with a higher survival rate expected due to increased work in protection of the young trees. C.A.R.E. has found that individually-fenced trees, using thorns or grass mats, provide the best possible protection and the lowest cost of time and labor.

Another organization also involved in the planting and protection of Gao's is the Fund d'Assistance et Co-opération (F.A.C.) F.A.O. has begun a two year experimental project to try and plant the Acacia Albida in productive fields of cotton and millet to hopefully increase the productivity of fields that are now exhausted by continuous farming without time to lay fallow. At the end of the two year experimental program, the results will be collected and if the project has proven successful, the Fund European de Developement (F.E.D.) is prepared to fund the continuation of the project for another five years.

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The project involves using local farmers as volunteers who plant the Acacia Albidas provided by Eaux et Forêts in their fields during the rainy season. The project puts a great deal of emphasis on the value of the Acacia Albida to the local farmer, and a lot of time is spent talking with farmers about the tree's value as a source of organic nutriment and as a source of food for grazing animals during the dry season. However, to insure the participation of the farmers particularly in the protection of the trees from goats and wild fires, a cash encouragement of 10 francs CFA is going to be paid to each farmer for every tree which is alive and well at the end of the dry season in May. This project will use individual fencing of thorns or grass mats for protection against grazing animals and wide bare-ground fire lanes to protect the plantations of brousse fires.

This project will also involve a research phase in which 10 parcels, 25 meters X 25 meters, have been laid out. Five of these parcels are completely covered with large Acacia Albidas and five adjoining parcels are completely free of Acacia Albidas. The experiment is to determine whether or not Acacia Albida does actually improve the growth and productivity of millet, and if so, how much. The millet in the parcels is being measured for height growth every fifteen days and when the millet is harvested, the grain will be weighed to get the comparison between those grown under Acacia Albidas and those grown without Acacia Albidas.

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WINDBREAK PLANTING

AN ALTERNATIVE SOLUTION

by

Tom Shaw

Peace Corps - Niger

August 1977

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WINDBREAK PLANTING : AN ALTERNATE SOLUTION

INTRODUCTION

The purpose of this study is to present an alternate method for planting a windbreak given the specific task of protecting the area under cultivation around a village rather than the village itself from further damage by wind erosion. Ordinarily windbreaks are planted in long (1000 meters or more) rows of parallel lines evenly spaced over a given region and perpendicular to the direction of the wind. Under the proposed method the windbreaks will be planted in rows of short sections set in a semi-circular pattern completely covering the cultivated area around a village.

DISCUSSION OF THE STUDY AREA

The Dallol Boboye, an ancient drainage channel of the Niger river, runs from Filingué in the north, due south passing through Birni-N'Gaouré until it reaches the Niger river. The Dallol, a Fulani word, is the valley that is formed between two sets of ridges. The width of the Dallol varies from as little as two kilometers to more than ten. Rainfall in the region ranges between 600 to 800 mm. per year. The rainfall is at a minimum inthe north and increases as one goes south. Normally the rainy season begins late in May or early in June, and continues until late in September. At all times of the year the water table is located approximately one to five meters below the soil surface. The prevailing wind comes from the south-east but varies up to 30 degrees either side of this.

The windbreak project is located in the southern half of the Boboye around the village of Tonka sarre. Tonka sarrè, a small Djerma village of about 150 people is located 52 kilometers south of Birni-N'Gaouré and 6 kilometers south of Bélandé. The purpose of the windbreak is to protect the terrain under crop production and prevent further loss of the soil's fertility due to wind erosion. At the time of the project the terrain was almost bare of trees and shrubs.

The land is cultivated in roughly a circle around the village, the majority of which is located on the north-west side of the village in a semi-circle from northeast to southwest. Very little of the land behind the village (south) is cultivated because of the presence of a cattle route, 50 meters wide, leading to the Niger river. The planting zone in front of the village has a maximum depth of 1200 meters and a width of 2000 meters.

METHODS

Given the task of protecting the local fields and the varying wind direction I decided the most efficient means of protection would be to plant the windbreak in rows of small sections 300 meters wide and forming semi-circles around the village. The majority of these will be placed on the northwest side of the village.

First a rough map of the area should be prepared. This will be used to decide on the number of sections per semi-circle (see example.) After this has been completed one begins by placing the first section parallel to the village (perpendicular to the wind) and 150 to 200 meters out. This leaves the area directly in front of the village free for its future expansion. The section should be wide enough to completely cover the width of the village. Thus allowing the other sections to effectively encircle the village. For Tonka

sarré this was found to be 400 meters. Next one must calculate how many 300 meter sections will be necessary to cover all of the cultivated area. This is found by subtracting the 400 meters from the maximum width of the area, 2000 meters, and dividing this by 300. Thus each semi-circle will consist of one 400 meter sections and five 300 meter sections a total width of 1900 meters. Next decide on what the spacing will be between each row. The rule of thumb is 20 times the maximum expected height of the tallest species used. Since in this case only Prosopis juliflora was used, which has a maximum expected height of 7 to 8 meters, this distance will be 150 meters. Finally the number of rows of semi-circles can be calculated. This will depend on the depth of the area cultivated (1200 meters), the spacing between rows (150 meters) and the number of trees available. In this case it is five.

At this time the make-up of each section should be explained. Each will consist of three parallel lines spaced one meter apart and having the second and third lines offset from the first by one and two meters respectively. Theoretically each line is planter with a different species. Ideally the first species should be a large bush or a small tree to protect the area close to the ground. The second species should be medium sized tree (7-8 meters) and the third species a large tree (10-15 meters.) For example, one possible combination would be Parkinsonia aculeata, Prosopis juliflora and Parkia biglabosis (Neré) - The trees are then planted every third meter along each line. This will place one tree every meter of the windbreak because of the offset of the second and third lines.

At this point work at the site will begin. Only shovels and a compass will be necessary. All of the measurements are done by pacing i.e. the length of the lines and the spacings in between them. This will eliminate the time consuming task of measuring with a rope or chain and is just as accurate. Three people will be needed to mark the line while the rest of the workers are digging the holes for planting. Marking is accomplished simply and efficiently by having one person find the line using the compass and a second person to serve as the mark for the line. The third person will then mark the line formed between these two. The person marking the holes paces three meters marks the place, using a shovel, then paces three more meters, marks, continuing in like manner until he reaches the second person. At this point he will turn around and begin marking the second line, offsetting it by eye. After the second line has been completed he will then mark the third line in the same manner. At the same time the other two people will be lining up the next part of the line. Each section will have 100 holes per line for a total of 300 per section.

I think it is best to start by placing the group of five 400 meter sections first to insure that they are centered on the village. After each section is finished you will pace 150 meters and begin the next row. When the group has been finished you will pace back half the distance (see example) between the rows (75 meters) and begin the placement of the next groups of sections (300 meter sections); This will continue until all the sections have been marked and the holes dug. If there is an obstruction such as a marsh the line is just shortened the appropriate distance (A on the example) and added where it is deemed most necessary (B on the example). Now you will wait for the rains in order to plant the trees.

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RESULTS AND CONCLUSIONS

As a result of this method 10 kilometers of windbreaks were marked and the holes dug in 5 days. The work would have been finished in four days if it hadn't rained on two of the days. On the fourth day 3195 meters were finished in 4 ½ hours using 16 workers to dig the holes. Thus I think that an average of 2700 to 3000 meters per day can be expected, weather permitting, with a work force of 19 people. The actual planting of the trees was done by "Operation Sahel-Vert" for which reason the amount of time necessary to plant each kilometer has not been calculated.

In conclusion there are many advantages to this system. The semi-circles effectively trap the wind through a wide range of wind directions. Secondly the small sections are much easier to mark than long straight (parallel) lines. Keeping the lines exactly straight and parallel is not as critical because the lines are not long enough to have the problem of convergences. Thirdly small changes due to local obstructions, i.e. marshy areas or roads, can be easily accomodated. They are also more easily adapted to fit the overall pattern of cultivation around a village. Fourthly the small sections eliminate the problem of having to much of the windbreak in any one person's field. Fifthly the visual impact of many small sections may be less than with long straight lines in the minds of the local inhabitants thus decreasing the possibility of their being cut down.

Thomas Shaw PCV
Birni-N'Gaouré

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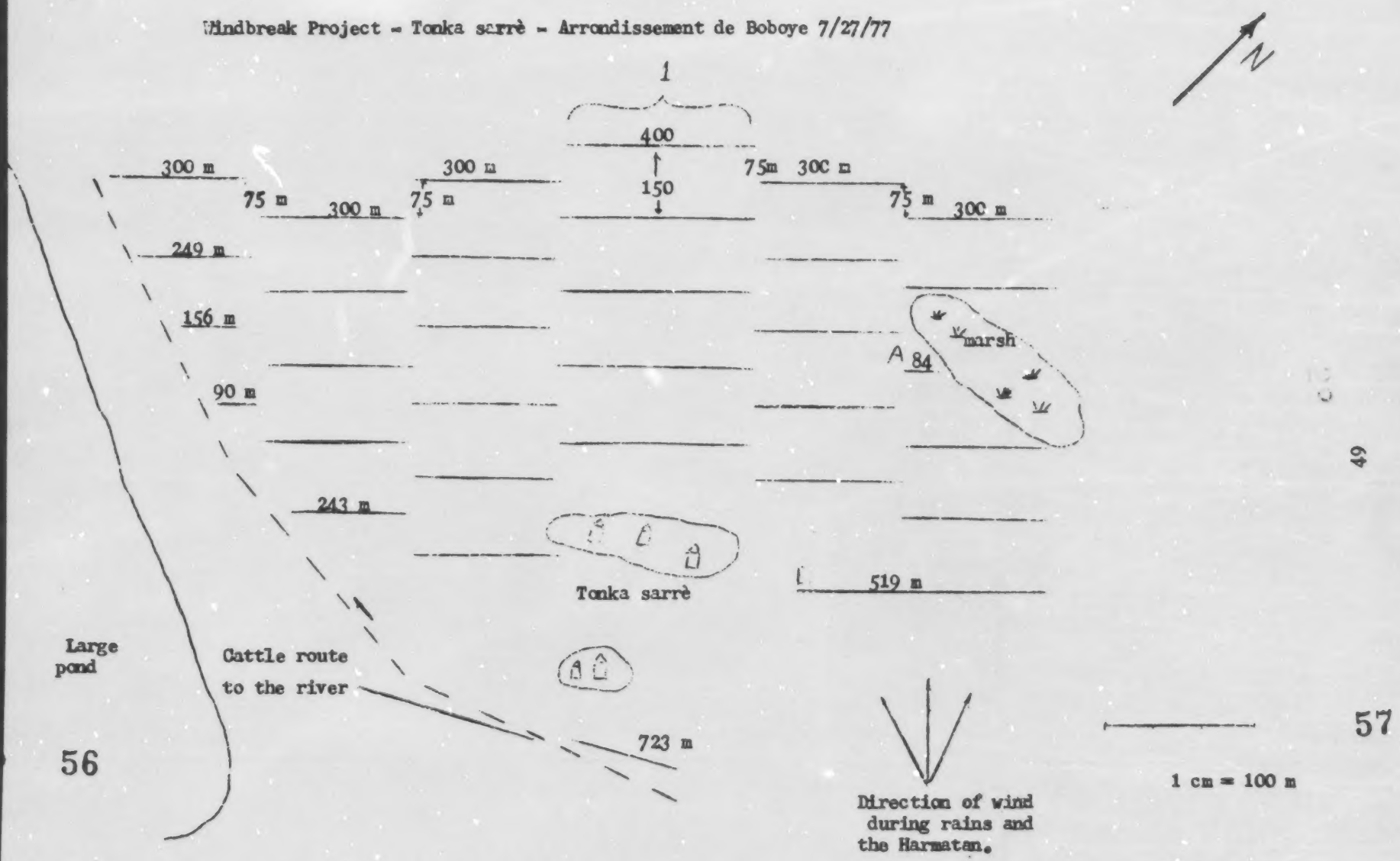
Windbreak Project - Tonka sarrè - Arrondissement de Boboye 7/27/77



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NOTES
ON THE DIRECT SEEDING OF
ACACIA SENEGAL

Leonard Malczynski
Corps de la Paix
Eaux et Forêts
Bader (Dakoro)
Diffa - Niger -

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IV Advantages and Disadvantages

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1. Speed
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3. Results

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1. Seed requirement
2. Risk
3. Wind problems
4. Cultivation

V Recommendations

Appendix I Species differentiation : A. laeta, A. senegal

Appendix II Results of damage from a random sample of shelled seed

Appendix III Rain calender - Bader : June, July, August 1976

Appendix IV Man/hours table

I Introduction

These notes are the observations acquired after 49 hectares of direct seeding experience with Acacia senegal near the village of Bader in the Arrondissement of Dakoro. They in no way represent a scientific study but merely a practical attempt at reforestation by direct seeding. I do believe that they are worthwile and at least provide a foundation for further attempts in the direct seeding of Acacia senegal.

II Preliminary Work

A. Seed collection

Seed collection is carried out well before the seeding operation. Generally both Acacia laeta and Acacia senegal are ready to drop seed in November-December. I have found that the seed of A. Laeta is ripe before that of A. senegal in the same region; unless you prefer a mixture of the two species instruct your collecting crew in the means of differentiating the two species (see Appendix I).

You may want the local inhabitants to collect seed for you. Pay them by whatever standard measure is convenient explaining well that the seed must be hand removed from its shell. In this case expect to receive a mixture of the two species.

Hand removal is superior to that done by pounding in a mortar. Up to 50 % of the seed can be damaged by pounding them in a mortar (see Appendix II).

B. Piquetage

Piquetage is a must for direct seeding. The gum trees, when germinating, will be very difficult to see and thus a well placed piquet will greatly aid in cultivation. The piquets also facilitate survival estimation and the actual direct seeding operation.

C. Cultivation

If we consider the plantation site, in a sense, a large plastic pot, it is easy to see why cultivation is important. Rapidly growing weeds easily out-compete the gum seedlings for light, water, and soil space. The best method would be to cultivate the area before seeding. This may cause problems in farm fields. Cultivation can be done after germination to be followed by hand cultivating near the plants themselves. Probably the most important point is that the seeding must always be done to the same side of the piquets, i.e. always north, east, etc..This must be made clear to whomever is cultivating or your direct seeding effort will be easily and quickly eliminated.

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The question of whether or not to seed in agricultural fields will be up to you and the local farmers. An agreement can be arranged to do live fencing, or a staggered seeding over a number of years. At any rate make them well aware that after the third or fourth year the no use rule goes into effect.

D. Fencing

It is not necessary to describe the advantages of plantation fencing. No plantation can expect to be successful with the free passage of people, vehicles, and animals. Thorns or wire will be required and live fencing can and should be included.

III. Seeding and Survival

A. Grain Treatment

The quickest and most effective treatment is soaking the seed from 12 to 24 hours in water at air temperature. Much germination success can be obtained by placing the seed in water the moment a good rain is finished, to be used for seeding the next day. Otherwise if the soil already contains sufficient moisture the seeding can be done at your convenience. The idea is to have the tap root of the seedling follow the soil rain water down to the seasonally elevated water table. (see Appendix III).

B. Depth

Again, consider the plantation surface as a large plastic pot. The seed should not be sown deep as there is a tendency for it to rot, or not reach the surface even if it does germinate. An adequate depth is from 2 to 4 cms.

There are several ways to form or scoop the seed hole. The most effective in terms of seed germination is to form the hole by hand, as this method yields a fairly constant hole depth. The method is slow and depends much on the soil texture. Several tools and improvisations thereof are useful. These range from long and short handled hoes to piquets. These tools speed up the operation but care must be taken to control the seed hole depth.

C. Containers

Bringing the treated seed to the site in easily manageable con - tainers is of great help. Buckets or watering cans can be used as the seed can be treated in these the day before seeding. Small hand held containers are required for the seeders. We found 1/2 liter or 1 liter plastic goblets to be effective. Most metal containers are also fine, although containers of smaller than 1/2 liter will necessitate frequent trips to the larger seed containers.

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D. Logistics

Seeding teams of two men per line are effective, as one man forms the hole the other then throws the seed into it, fills it, and firms the loose soil with his foot. One man can effectively do the same but much is lost in speed.

The number of seeds per hole can be disputed; our experience being to take a small group of seed 10 to 15 between the thumb and first three fingers and then throw them into the hole. This number should obviously depend on whether the seed was hand shelled or shelled by pounding, the pounded requireing the larger number i.e. 10 to 15 .

Most of seeding was done before 10 a.m. to assure that the seed was on wet ground. Near Diffa excellent results were obtained with afternoon seeding.

IV. Advantages and Disadvantages

Advantages

1 Speed - assuming that the direct seeding operation is not the only operation of the year, it is fortunate that it can be quickly accomplished during a limited rainy season, even within a few days.

2 Requires less preliminary work - this is with respect to the pépinière. Most operations require fencing and cultivation at any rate so those months needed to grow potted stock with A. senegal are left less burdened. Also being able to effectively reforest at a lower cost and with less training of personnel, should be of help anywhere in the Sahel.

3 Results - with germination within two days and up to 90 % in a week, this technique should be given some thought.

Disadvantages

1 Seed requirement - if we consider one plastic pot or one piquet as a unit, direct seeding will require 2 1/2 to 5 times the amount of seed as potted stock operations for the same sur - face area (i.e. 3 seeds/pot and 15 seeds/piquet).

2 Risk - whereas potted stock can be fairly well controlled as to soil; water and light competition, direct seeding has no advantage in this area. Of course field climatic conditions decide the survival after direct seeding or planting, however potted stock has an initial growth advantage. Deciding when to seed is also risky as rain is needed soon after seeding.

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3 Wind problems - windblown sand collects on organic matter trapped by the thorns of the young seedlings. The taller potted stock are usually not completely buried as is usually the case with the seedlings. Occasional clearing of the collected debris will be necessary to ensure the seedling's survival.

4 Cultivation - direct seeded A. senegal is not as prepared for competition as potted stock. Careful and close cultivation is require including the thinning out of each group of gum seedlings.

V. Recommendations

I was impressed by our results, especially since direct seeding attemps are rare and poorly documented. Nevertheless our work will not make direct seeded Acacia senegal the panacea of reforestation in the Sahel. Obviously more work is needed, more in the realm of small scale attempts in different regions rather than large single site 'proofs' of Acacia senegal's direct seeding possibilities. Carefully kept records of rainfall, rain water soil penetration, and the effects of cultivation would be a start. If some method can be determined to take a bit of the guesswork out of when to seed, many more attempts may be made .

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Appendix I - Species differentiation : A. laeta, A. senegal

Similarities

1. Small tree, usually up to 8 meters.
2. Bark greyish tan, with small fissures and flaking, the base of older trees dark.
3. Compound pinnate leaf.
4. Thorns on the stem and small spines on leaf petiole.

Differences

Acacia laeta	Acacia senegal
wide leaflets	narrow leaflets
usually 2 thorns in a group, pointing perpendicularly outward or away from the apex of branch, if thorns are a triplet they all point downward	usually a triplet of thorns, the two laterals pointing upward the central thorn downward, if only two both point downward
dark thorns	purplish thorns
wider shorter seed pod	narrower pod, often constricted.

Appendix II - Results of damage from a random sample ef shelled seed

sample number	1	2	3	4	5	%
number of good seed	137	67	87	52	141	56
number of bad seed (cracked, aborted)	80	71	68	32	123	44

taken from Rapport mensuel du mois de Decembre 1975
Projet Gommeraie 1-1-76 L. Malczynski - Dakoro .

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Appendix III - RAIN CALENDAR - BADER : June, July, August 1976

8 = rained that day

8 = seeded that day

June

M	T	W	T	F	S	S	
20	21	22	23	24	25	26	poor results much damage done
27	28	29	30				by cultivating

July

				1	2	3	
4	5	6	7	8	9	10	
11	12	13	14	15	16	17	excellent results
18	19	20	21	22	23	24	
25	26	27	28	29	30	31	

August

1	2	3	4	5	6	7	poor results
8	9	10	11	12	13	14	millet more than
		24					2 meters high

Appendix IV - MAN/HOURS TABLE

Day	N° Piquets	N° Men	N° Hours
14	2 500	6	3
15	2 620	-	-
16	3 680	-	4
17	3 890	6	4

In DIFFA	1,000 meters	with seed	approximately	each meter
	1 000	7		1

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VILLAGE REFORESTATION

by

Andrew Gibbs

Peace Corps - Upper Volta

August 8, 1977

August 8, 1977

VILLAGE REFORESTATION

I. Project Locale - The project is being executed in the Sous-Prefecture of Kombissirei, Prefecture of Ouagadougou, Upper Volta. In all, twenty villages and village groups, all of the Mossi ethnic group, are participating in this pilot zone. Kombissiri is located 42 kilometers south of Ouagadougou, while each village is within 40 kilometers of Kombissiri. Located in the northern-Soudanian climatic region, the average annual precipitation is approximately 900 milimeters. Soils are tropical ferruginous with a surface layer poor in organic matter and often sandy or argillaceous. The vegetation is typical of that found in the Soudanian zone, yet being in an area which is heavily populated and cultivated most of the original wooded savanna is deforestated. Families can no longer find household wood needs from within their immediate surroundings. Wood is either hand gathered by women or transported into the villages by donkey-drawn carts. Not one village within this project has had a previous plantation while only a few individuals have recently planted such species as Neem (Azadirachta indica), Cassia (Cassia siamea), and Gmelina arborea , for the most part around the family compound.

II. Technical Responsibility - The technical responsibility of the project's execution comes under the Office of Forestry Management and Reforestation of the Ministry of Environment and Tourism (Direction de l'Amenagement Forestier et Reboisement du Ministre de l'Environment et du Tourisme). One forestry agent has been assigned full-time to this project. Also, assistance comes from the personnel of the United Nations Development Program (UNDP), personnel of the framework of the Sous-secteur of Kombissiri within the Ouagadougou ORD. Material and equipment such as a Land Rover, gas and tools are provided by the UNDP. Trees are bought by the UNDP from a large forest nursery at Nagbangre, 16 kilometers from Kombissiri.

III. Project Goals - The objectives of this project will be divided between those long-term and those immediate. In all cases it is of primary importance that there be a good success before financing continues for other such projects.

A. Immediate objectives :

- to mobilize and educate the rural population in view of the need for a better environment.
- to bring to the villagers' awareness the need for reforestation.
- to teach villagers the methods of reforestation (i.e. how, when, and where to plant trees, how to maintain and harvest them).

B. Long-term objectives :

- to stop the desertification and deforestation of the Sahel.
- to protect the soils and crops against drying winds and erosion.
- to furnish fire wool, construction wood and supplementary resources such as fruits, tanins and leaves used for medicinal purposes.
- to provide shade trees and wind breaks around fields and houses.
- to ameliorate the micro-climate and esthetics.
- to alleviate the pressure on natural covar.

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IV. Organization of the Project at the Village level

A. Meeting at the Sous-Prefecture : On May 17, 1977, a meeting was held at the office of the Sous-Prefecture in Kombissiri in order to discuss the ramifications of this project. In attendance was everyone who is technically responsible to the project as well as Canton chiefs, Canton secretaries, village chiefs, and those responsible for village groups (several neighborhoods within a larger village). At this meeting most all of the major points of the project were discussed. The name of each interested village and village group was inscribed after which a schedule was prepared in view of the visits to each village.

B. Tourney to each village : On May 20 and 21 we visited each of the twelve original villages. Upon arrival we went directly to the chief's house before continuing with him to the chosen plantation site. Most villages had decided to plant one hectare (in the end two villages planted 2 hectares each while two others planted $\frac{1}{2}$ hectare each). Then the forseen plantation site was roughly outlined using 50 meter cables and stakes. We then told the chief and villagers to prepare the quantity of stakes necessary to picket the terrain (each plantation has a spacing of 4 x 4 meters, thus 625 stakes/hectare). On one occasion we recommended the village chief to choose another site because the terrain of his previous choice was already reforestated with many native trees of all ages. Before leaving we asked the villagers to prepare the stakes, to clear the site of vegetation excepting large fruit bearing threes such as Karite (Butyrosperum parkii) and Nere (Parkia biglobosa), and to fix a return date on which we would assist in doing the picketing. At later dates nine other villages contacted either the Sous-Prefecture or Sous-secteur of the CRD in order to express their interests in the project. Afterwards, at convenient times we visited these villages in order to complete the aforementioned work.

C. Picketing the Plantation : At the first meeting it was understood that all the work would be done by the villagers. If the site had been well cleared, all the pickets had been prepared and enough workers were present to help, it was easy to finish the picketing of one hectare in 2-3 hours. We used a level to determine 90 degree angles, although we could have used a 30 x 40 x 50 meter triangle to find the square. At first several plastic coated nylon metric cables were used. These stretched enormously while it was difficult for the average peasant to read and comprehend the numbers. Later we used a hemp rope on which there was a simple overhand knot every four meters, the desired spacing between trees. This latter method proved to be more efficient and accurate.

D. Digging the Holes : After finishing the picketing we explained to them to dig the holes as soon as possible. We gave instructions on hole size, specifying a diameter and depth of 50 centimeters. Villagers were told to place the topsoil to one side of the hole and the subsoil to the other side. Thus when one plants he could put the better soil in the bottom of the hole where its nutrients will be readily available to the seedlings roots. Picks, shovels, coupe-coupes, and iron bars were loaned to villages upon request in order to facilitate the digging. We learned that it was best to have one person in each village be responsible for returning the tools.

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E. Plantation : Planting began on July 21 after a heavy rain. First we delivered trees to those villages who had finished the hole preparation. We tried to contact the villages before bringing the seedlings. In this manner, with a fixed date we were assured that the villagers would be present to plant the same day. However we arrived at some distant villages without prior warning because it would have consumed indispensible time. In all such cases the bare rooted plants (Cassia, Neem, Gmelina) were planted the following day if not the same. Therefore in each village we dug small holding beds for the Eucalyptus pots and holes to protect the bare root species. It was essential to keep the moist and muddy roots from drying. All holding beds were dug next to the plantation site under a large shade tree. In some cases Eucalyptus were kept several days in beds, but villagers were instructed to water them. On the average we delivered an equivalent number of Cassia and Eucalyptus to each village, besides the Neem, Gmelina, and native trees that were requested. We told villagers in advance that trees would be available for individual plantations. We asked the chiefs to determine the total number of plants and how many of each species each villager wanted. The idea was to bring the additional plants the same day as those for the village plantation. In all cases we showed at least the village chief and others of his family how to plant each species. When possible we stayed to watch the villagers plant in order to assure ourselves that the planting was done correctly. Preliminary investigations indicate that there will be little mortality of Eucalyptus due to droughty conditions. It is still too soon to determine the outcome of the bare root plants.

V. Discussion of Problems Encountered

A. Punctuality : Often villagers did not respect a rendez-vous; thus it was necessary to either do the work ourselves or come back at a later date. One should be sure that the time and date is well understood. He can explain that there is no gas with which to make unnecessary trips.

B. Lack of help on work days : This happened most often when we arrived to do the picketing. Also, some villagers had not prepared a sufficient number of stakes, thus slowing work. It should be understood by all villagers and chiefs that it is they who will receive the benefits of the plantation and that they are expected to do the work. Most chiefs divided the work proportionally among the families, but in some cases they lacked the perserverance to encourage the people to finish the work in a given period of time.

C. Loss or lack of interest : This was evident in several villages. Most people were so preoccupied with sowing or cultivating crops that they took no interest in the work. Others had difficulty digging the holes due to the hard ground. Thus several plantations were delayed because the holes were not prepared. In some cases the holes were dug and the trees were planted on the same day. Frequent contact with the villagers induced more enthusiasm. At the beginning of planting we distributed 3.500 francs CFA (for each one hectare) to each chief with which he was supposed to prepare either food or drink for those who participated in the work. After eating or drinking the people were quite satisfied and in better condition to work. The long term solution to the lack of interest is education.

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D. Uncertainty of individual plantations : At the beginning of the project it was explained that trees would be available for individual plantations. We asked the chiefs to calculate the total number of species for individual plantations. In the end we rarely received a precise figure for either species or the total number or plants. Therefore we had to decide ourselves how many trees to bring for individual plantations. The average number of extra plants was between 300-600, for the most part Cassia and Eucalyptus. Then the question was whether or not these plants would be planted the same day as those for the village plantation. In most villages, we can assume that they were planted the same day, however in one village we remarked that approximately 100 Eucalyptus remained in the holding bed for one week or more. In another village, some Cassia stumps remained in a hole for one week. In all cases it was explained that the trees should be planted as soon as possible, especially those planted with bare roots. In no case did we leave bare root seedlings in a village where the chief wes not able to assure us that they would be planted at the latest the next day. Considering the cases in which trees were not planted immediately, it is doubtful that the holes were prepared in advance. On the other hand, perhaps the chief was irresponsible in the distribution of plants. For following years it will be necessary to stress the importance of planting as soon as possible. The chiefs should determine precise figures in advance and at the same time ask the villagers that the holes be dug beforehand. In such a manner, there will be less waste of time, effort, and trees.

E. Plant loss to livestock : At first it was previewed that fencing would be available for the protection of plantations. Afterwards it was decided that guardians would be used in place of fences and that alimentation would be given to the guardian each month. Some village chiefs are absolutely opposed to the idea of a guardian while others have agreed to this method of protection. The problem will be to convince all chiefs to take some protective measures. Moreover, we must assure ourselves that the protection is provided. We have already noticed much foliage loss of Eucalyptus to sheep and goats. If this problem is not resolved some plantations may fail. In the future it is recommended to plant Eucalyptus within family coumpounds and other areas under constant surveillance.

F. Lack of Education : Each of the above mentioned problems directly stems from the lack of education. There is need for a basic understanding of ecology as well as for a knowledge of forestry practices. The rural populations must be sensitized before they can actively interest themselves in reforestation. One should relate statistics, give demonstrations and show illustrations before they will realize the deleterious effects of present forestry practices. Because this project began in mid-May it was nearly impossible to take adequate time in each village in order to motivate and sensitize the countrymen. Efforts should be made during the dry season to return to each village and pursue an education program.

Andrew Gibbs
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AFFORESTATION IN N'GUIGMI

by David Kendrick
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Niamey - Niger

August 1977

AFFORESTATION IN N'GUIGMI

I. Description of Area

II. Factors Influencing Afforestation

A. Positive Factors

1. High water table
2. Rich soil
3. Artesian wells

B. Negative Factors

1. Climate
2. Protection difficulties

III. 1977 Afforestation Project

A. Projects Description

B. Results

IV. Conclusions

AFFORESTATION IN N'GUIGMI

DESCRIPTION OF AREA

N'Guigmi is located 8 kilometers from the northwest shore of Lake Chad in southeastern Niger. The town lies along the pres - cribed northern limit of farming. In recent years, annual precipitation has varied from approximately 80 mm.to 200 mm. The terrain is composed of more or less stabilized sand dunes, sparsely covered by grasses and small, brushy vegetation.

FACTORS INFLUENCING AFFORESTATION

A. Positive Factors

According to the local population, the waters of Lake Chad lay almost on the boundaries of the town of N'Guigmi as late as 1969. As it receded, it left behind a rich former lake bottom capable of supporting lush vegeta- tion. Local sources claim thet water can be found within four meters of the surface in many areas, and as close as one meter in some low - lying areas.

A densely forested area approximately one kilometer south of N'Guigmi illustrates the potential provided by the combination of rich soil and high water table. In this low-lying area, one finds a closed forest canopy of Prosepis juliflora and Parkinsonia aculeata. The surrounding area, separated in elevation by only two to three meters, is almost devoid of permanent vegetation within 100 meters of the area described above. Of the commonly occurring species in the arrondissement, P. juliflora seems to be especially well suited to the environment in and around the town of N'Guigmi.

Artesian wells in N'Guigmi provide an abundant source of water for the vital function of irrigating plants in the nursery. The constant,rapid flow of water enables more plants to be watered in less time than is pos - sible if water must be drawn from traditional wells. In N'Guigmi, the pumps are located at the Eaux et Forêts nursery, approximately four kilo - meters from the site of this years's project.

B. Negative Factors

The most obvious hindrance to afforestation attempts is the climate. In 1975 and 1976 , the annual rainfall totalled 85 mm. and 92 mm . respectively, much too low to expect success in establishing trees. The lack of adequate rainfall, extremely high temperatures, and seasonally strong winds combine to create an environment too harsh for all but the hardiest of drought resistant vegetation.

Protection of the trees after planting is a problem as serious, per- haps, as the lack of rainfall in the N'Guigmi area. Adequate fencing using native materials is virtually impossible due to the scarcity and small size of the thorny vegetation in the vicinity. Plants are, there - fore, left vulnerable to browsing damage by goats, donkeys, cattle, etc.

.../...

1977 AFFORESTATION PROJECT

The project this year is a 50 hectare area located adjacent to the densely forested area previously described. Approximately one-third of the area is covered by sand dunes. The underlying soil is former lake bed. There is virtually no natural woody vegetation on the area. P. juliflora is the only species being planted. The area is to be enclosed by a thorn fence.

The results so far look promising. As of August 6, 45 hectares had been planted. Rainfall is already near the 200 mm. mark. In addition, the timing of the rains has been spaced almost ideally. As a result, there is virtually no mortality and most of the plants appear strong.

As indicated previously, protection is, and will continue to be a problem. Thorns had to be pulled from a distance of about two kilometers by foot. At best, the thorn fence presently surrounding the plantation could not be considered a fence.

CONCLUSIONS

Despite the harsh climate, the first results of this year's project give cause for optimism for future projects. In addition, the need for some sort of vegetation cover on the area makes afforestation projects worth considering in the future. The problem of protecting the plantations will have to be overcome. Adequate protection could be provided by a barbed wire fence interlaced with thorns. Fewer thorns would be required than for a fence made entirely of thorns. In the event that barbed wire is unavailable, the size of the plantation could be restricted to an area, for example, 20 hectares. In that way, the available thorns could be consolidated to form an adequate fence.

VEGETATION INVENTORY ON THE DINDERESSO FORET CLASSE

by

Arlene Hlade
Peace Corps - Upper Volta

August 1977

Vegetation Inventory on the Dinderesso Forêt Classé

The vegetation inventory being conducted on the Forêt Classé at Dinderesso is a United Nations Food and Agriculture Organization sponsored project. It's aim is to increase the base of knowledge available to Voltaic forestry agents charged with managing Forêt Classé, Game Reserves and National Parks. The structure of the project is simple enough that with appropriate technique and procedure modifications it can be applied to protected areas throughout Upper Volta. For the project at Dinderesso thorough information on soil types is the foundation. In situations where this information is unavailable primary use (e.g. wildlife or grazing), topographic features or other characteristics of a particular region can be used as the basis for the inventory. All technical work including project design, data collection and result interpretation is being carried out by Arlene Blade.

Specifically, the project is intended to provide to the UNFAO, the Service des Eaux er Forêts and the Ecole National Forestiere, 1) a vegetation map, 2) a verbal description of principal species on the Forêt Classé and 3) a discussion in report form of the procedures involved with and the implications of such a vegetation inventory. The fourth product, to be located at the Ecole National Forestiere, is the beginning of an herbarium collection to be maintained and expanded by the ten students at the school. Material support and technical information are being given by the Smithsonian Institution Environmental Program and Volunteers in Technical Assistance.

Design of the vegetation inventory is determined by major soil types which have been described and mapped in a soil survey done for the Centre Technique Forestiere Tropical in 1968. Of the three soil types on the Forêt Classé, lateritic, sandy and gravelly, vegetation populations on the lateritic and sandy types will be sampled.

Natural vegetation on the lateritic soil consists of shrub communities with grass understories, trees exceeding four meters in height are scattered, being restricted to areas of soil accumulation greater than one meter. These areas experience little man-caused disturbance because they are unsuitable for cultivation, but are commonly subject to natural brush fires and animal grazing effects. Natural vegetation on the sandy soils is a denser community of trees (greater than 3 meters height) usually with a shrub understory. Small, localized grass communities are interspersed either in low areas where there is standing water during the rainy season or in recently cultivated areas where shrubs have not yet re-invaded. Depth of the sandy soil is usually greater than one meter. It's water retention qualities are good making it attractive both for agriculture and reforestation. Indications of water or wind erosion are not prominent on either soil type. Rapidly invading grass cover reduces the potential of erosion on abandoned cultivation sites.

Lateritic soil covers approximately 2/3 and sandy soil approximately 1/3 of the Forêt Classé. The amount of gravelly soil is negligible and its distribution scattered such that vegetation it supports will not be sampled. Population size of the lateritic and sandy soils to be sampled is 800 and 400 hectares respectively. Emphasis of the inventory design is placed on soil types, the topography being relatively featureless, the slopes being constant and slight.

Within the areas to be sampled vegetation is heterogeneous; there are tree savannahs, shrub savannahs and scattered low-lying areas supporting seasonally wet grass/sedge communities. Choice of the most appropriate sampling technique is determined by the diversity of plant formations represented in the population. Plant formations in this context are determined physiognomically. To insure inclusion of each formation, a stratified system of sampling is necessary.

Within-stratum sampling will be systematic. The delineation of plant formations into discernable sample strata make a system of stratified systematic sampling the most thorough and least time-consuming method of data collection. A set of aerial photographs for the northern portion of the Forêt Classe is available to facilitate sample plot location on approximately one third of the inventory population. Samples will be taken along a grid system whose dimensions will be determined when necessary sample size has been decided.

Vegetation map - Data collected from the inventory will be used to compile a vegetation map. Major plant formations and their component tree, grass and shrub communities will be delineated. Accompanying the map will be lists of major and minor species comprising individual communities. Data taken from the inventory, providing abundance, density and frequency information, will be the basis for the map. Drawn to a scale of 1:5000, it should clearly illustrate the technique of visual vegetation classification and is intended to be useful as a tool in the field.

Species descriptions - A second product of the data collection will be a verbal description of principal trees and shrubs growing on lateritic and sandy soil types. Intended to be used as a tool for field identification, the plant descriptions will be in the form of a conspectus. The conspectus will provide comparisons and indicate prominent distinguishing characteristics of species within a genus. Written in the form of a chart, a conspectus facilitates identification of often-confused species.

Herbarium - In conjunction with the Ecole National Forestiere at Dinderesso, the third product of the project is an herbarium collection to be started from the specimens collected during the inventory. Explanations of the usefulness of an herbarium, methods of expansion and necessary maintainence will be given to the forestry students.

Project report - Procedures involved in the project and any recommendations to expediate future projects of a similar nature will be described in a report given to the UNFAO and Service des Eaux et Forêts. Suggestions for incorporation of the project's results into management plans involving reforestation, soil conservation, domestic grazing and wildlife will be offered as examples of the practical application of research findings.

In addition to the tangible products of this project, it is hoped that the importance of data collection, its interpretations and potential uses will be illustrated to Voltaic foresters. The vegetation inventory project at Dinderesso will serve as a proto-type for investigations of natural vegetation in other regions of Upper Volta. Modifications of the procedure used at Dinderesso would render the basic project design applicable to other Forêt Classé and to Game Reserves and National Parks. Expected completion date of the project is January, 1978.

Arlene Blade
PCV/Upper Volta

REFERENCES

1. Aubreville, A., Flore Forestiere Soudano Guineenne, Société d'Editions Géographiques Maritimes, Paris. 1950

2. Berhaut, J., Flore du Senegal, Clairafrique, Dakar, 1967.

3. Hutchinson, J., and J.M. Dalziel, Flora of West Tropical Africa, Her Majesty's Printing Office, London 1954, 1963, 1968.

4. Lawson, G.W., Plant Life in West Africa, Oxford University Press, London, 1966.

5. Lecture notes-Tropical Dendrology/Ecology, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho 1976.

6. Lecouzey, R., Manuel de Botanique Forestiers Afrique Tropicale, Centre Technique Forestiere Tropical, Nogent 1969, 1972.

7. Marin-Terrible, S., Atlas de Haute-Volta, Essai d'Evaluation de la Vegetation Ligneuse, Centre Voltaique de la Recherche Scientifique. Bobo-dioulasso 1975.

8. Memento du Forestiere Technique Rurales en Afrique - Republique Francaise Ministere de la Cooperation Paris 1976.

9. Sarlin, P., Pedologie Dinderesso, Forêt et Station, Centre Technique Forestiere Tropical, 1968.

10. Walter, H., Ecology of Tropical and Subtropical Vegetation Van Nostrand Reinhold Company, New York 1971.

DETERMINING THE PROPER DATE TO COMMENCE PLANTATION PLANTING IN RELATION TO RAINFALL

by

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August 12, 1978

DETERMINING THE PROPER DATE TO COMMENCE PLANTATION PLANTING IN RELATION TO RAINFALL

ABSTRACT

The economic success of large scale plantations is largely dependent on the growth made by the trees during the first rainy season.

The amount of growth is largely dependent on the date the trees were planted in relation to the rainy season. Therefore it is imperative that the plantation be started as early as possible in the season. However the determination of the best time to start planting has often been left to guesswork. By adapting methods used in agriculture to this problem the arid-regions forester may more easily make his decisions.

INTRODUCTION

The decision to start the planting of trees at the start of the rainy season and the daily decision as to whether or not to plant is dependent on the availability of water to the plant system and its capacity to utilize this available water. The availability of water to the plant is variable throughout the season as well as on a day to day basis and is a function of the water balance maintained in the soil. This balance is the net effect of the precipitation (minus any runoff) by which water is added to the balance, the capacity of the soil to store and retain water, and the actual evapotranspiration taking place at the site by the plant-soil system, by which water is removed from the balance. Therefore to be able to determine with greater precision the moment when the water needs of the plants will be satisfied it is necessary to understand as much as possible the factors involved in the addition, storage, and removal of water from this balance.

FACTORS

Precipitation is by far the most important factor involved and the most easily measured. Rainfall records are available in some areas for over 50 years and local records should be obtained where possible to better visualize yearly rainfall patterns and variations. Precipitation for the semi-arid zone south of the sahara is typically highly variable; on a year to year basis the co-efficient of variability may be as high as 30%. In general, the lower the annual precipitation for a region the higher its interannual variability. However, this is not always the rule, there being an area extending from Senegal through the north of Upper Volta to the west of Lake Chad that has consistently greater regularity in its annual precipitation even though it receives only 500 mm/year. This variability of precipitation exists also on the local scale on a day to day basis, whereby two weather stations separated by only a few kilometers will have significantly different rainfall figures and therefore would be of little use to someone wishing to employ those figures for a different site. Interestingly enough those highly variable figures tend to become more and more homogenious on a monthly basis and the differences even themselves out. However, monthly averages can not meet all the requirements in determing the water balance and therefore where ever possible a weather station should be installed directly at the site of interest.

The quantity of water stored in the soil that can be made available to plants depends on the structure and texture of the soil and has been estimated at the equivalent of about 100 mm. of rainfall. This actually can vary considerably and is probably closer to 50 mm. for a very sandy soil. Note that these figures were calculated by agronimists and are for annual crops; trees, at the time of planting may be limited in their ability to take up water due to broken root systems or nearly complete lack of root systems as in the case of trees prepared for planting by the bare root method. Therefore the quantity of water actually useable by seedlings may again be less than in the case of crops with normal root systems.

The actual exchange of water from the soil and plant surfaces back to the air (evapotranspiration) is a rather complicated affair and can not be determined without a great deal of equipment. An approximation of the rate of loss through ET is given by the evapotranspiration potential (ETP) and for tropical climates the formula determined by Penman is thought to be the most accurate. As long as the soil surface is moist, the ETP will be a close approximation of the real evapotranspiration (ETR) but with increasing dryness of the soil surface the ETP would be higher than the ETR. The parameters involved in determining ETP are related to the drying power of the air and the net energy available for evaporation. It should be emphasized the ETP is the actual potential or ability of the air to absorb water vapor from a moist surface, given the qualities of that surface. Because of the design of the ETP formula for agricultural use the surface is given to be that of dense green foliage covering the ground. This is not the case in plantation situations. An adaptation of the formula for different types of ground cover would render the formula more valuable to the forester. The measurements needed to calculate ETP through the formula are a bit complicated, involving measures of sunshine, temperature, vapor pressure and wind speed. However, it has been found that ETP values given by the Penman formula are closely related to two rather simple meteorological measurements, evaporation and relative humidity. The relation is thus : ETP (Perman) = E/2 - (1.25H) where E is the evaporation from a Class A Bac in mm. of water/unit time and H is the average relative humidity for that same unit of time. Relative humidity is easily measured by the dry bulb wet bulb hygrometer. A Class A Bac is actually an open water tank of specified dimensions, positioned so as to be exposed to the elements of sunlight and wind as they occur naturally on the site. It is equiped with a veneer scale to measure the drop in the surface level in mm. An acceptable approximation of a class A bac could easily be constructed and for our purposes even a large pail, or water barrel filled nearly to the top and equipped with a measuring device would suffice. A veneer scale can be made with a length of wood, 2 long nails, some light wire and a metric ruler as illustrated. Placed across the tank using the wood to support the affair and filling the tank just to the leveling wire, the daily drop in mm. is measured by the distance in cm's from the right hand nail to the point where the water surface intersects the sloping wire.

Besides determining the local ETP using such devices as dercribed, all sahelienne countries have weather stations that have calculated quite accurately the average yearly, monthly and sometimes daily ETP values for that area according to past weather data available. If a given site shares approximately the same latitude with these stations their averages could be taken as representative for that site also.

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APPLICATIONS

The usual application of average ETP data is to plot it on a graph with the average rainfall, either on a monthly basis or using 10 day averages if available. The value ETP/2 is also plotted. The point where ETP/2 equals precipitation is the start of the "moist" period. When precipitation = ETP the "humid" period is said to have begun. These periods have been named such in an attempt by agriculturalists to better define the rainy season. Their value to the forester is to indicate the approximate date when he may consider planting, usually not before the precipitation has reached the value of ETP/2. However, this date will only be accurate if the season is identical to the "normal" season as determined by the past yearly data used to formulate the graph. With the variability of rainfall found in the sahel it is indeed the year that the precipitation is not normal that current ETP data would be the most useful to the forester. In such years mistakes may be more easily avoided if even approximate values of ETP could be calculated on a daily basis for the plantation site, and the ratio of P/ETP considered on perhaps a 5 or 10 day basis. This data would be valuable in evaluating the actual water balance and also in comparing the season in progress with average seasonal data. The threshold value of P/ETP below which it is inadvisable to plant has not been determined for the forester as of yet. Ex periments with Eucalyptus camal. planted "en stompe" were carried out near Ouaga in 1976 by the CTFT and when rainfall and theoretical ETP values were compared with survival percentages it appeared that an P/ETP ratio of about 1 was required for survival of 80% or more. An experiment with E.o. in plastic pots was carried out this year at Dinderesso during the months of May and June, however the rainfall was so abundant during this period that the survival percentages were uniformly high (over 90%) and no threshold was perceived. The ratio of P/ETP was at all times equal to or superior to 5 during the experiment using theoretical ETP values for the station at Bobo-Dioulasso, 18 kilometers away.

If the minimum value of P/ETP needed for successful planting were known (or estimated) the amount of precipitation necessary to maintain or surpass this threshold level could be easily determined either from theoretical ETP data from a nearby weather station or from approximations made on site, or preferably both. If rainfall records for the region are available for at least 10 years, a probability chart could be worked out giving the probability of whether the required rainfall for a given period (usually 10 days) will actually occur. An example to illustrate. Assume that a P/ETP ratio of .5 is desired to start planting. The date is June 1st and the ETP for the last 10 days was 60 mm. 30 mm. of rain fell during the same 10 day period, therefore the P/ETP ratio is .5. Average ETP figures from anearby weather station (or predicted from data taken on site) say the next 10 days should have an ETP of 50 mm. Therefore the required rainfall to maintain P/ETP greater than or equal to .5 is 25 mm. over the next 10 day period. Referring to rainfall charts representative of the area, count the number of years that the rainfall was greater than or equal to 25 mm. for the period June 1-10. If charts are available for 10 years and 7 years experienced 25 mm. or more of rain from June 1-10, there is a 70% chance that the rainfall requirements for successful planting will be met. The accuracy of such a prediction will depend on the number of years of data represented in the rainfall records and the actual range of variability of the rainfall for the specific region.

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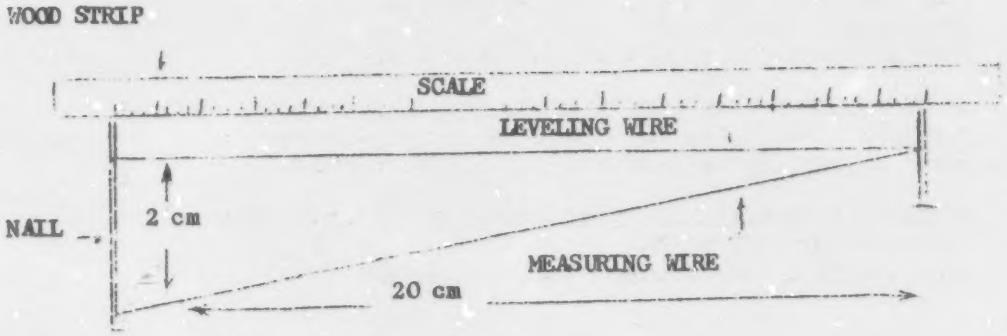
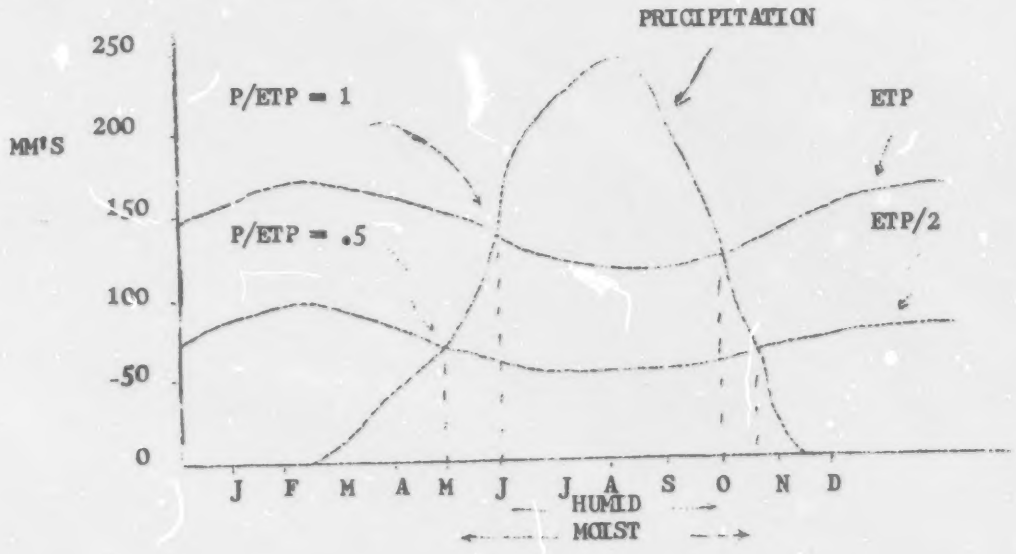
Such information as is given here should not be depended on uniquely in determining whether or not conditions are favorable for planting, in fact they are as yet unproven and untested for forestry applications; but used in conjunction with a knowledge of the prevailing local conditions it is believed that they will increase the successfulness of the foresters efforts.

Peter Wright PCV Forester
12 August 1977 Upper Volta

Figure 1 : CLASS A BAC



Graph 1 : DETERMINING WHEN TO PLANT



REFERENCES

CENTRE TECHNIQUE FORESTIER TROPICAL
Rapport annuel 1976 Haute Volta
Ministre de l'Environnement et du Tourism Ouagadougou RHV

TREE PLANTING PRACTICES IN AFRICAN SAVANNAS
FAO Forestry Development Paper
Food and Agriculture Organization Rome Italy

AN AGROCLIMATOLOGY SURVEY OF A SEMIARED AREA IN AFRICA SOUTH OF THE SAHARA
W.M.O. no. 210 TP 110 FAO/UNESCO/WMO Interagency Project on Agroclimatology
World Metcorology Organization Geneva Switzerland

ETUDE AGROMETEOROLOGIQUE DE LA REGION DE BOBO-DIOULASSA
W.M.O. Project RAF 74/079
Directeur de la Metesrologie Ouagadougou RHV

VILLAGE WOODLOTS AT MAGARIA

by

David Bahe

Peace Corps - Niger

Eaux et Forêts

August 1977

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Village Woodlots at Magaria

The main project that we are involved with at Magaria is the Village Woodlot Project, which is funded by the C.R.D.I. (Centre de Recherche pour le Developpement International). The project is currently in its third year at Magaria. There are 19 villages involved in the project, totaling 51 hectares of woodlots. The plantations range in area from 2 to 4 hectares, with most of them being 3 hectares.

The goal of the project is to provide the villages with a close source of firewood, poles and posts for construction purposes. Hopefully having these woodlots will help to eliminate some of the illegal wood cutting presently taking place. Also, it will supposedly diminish the necessity of the people to burn millet stalks and manure. Thus the soil may be gradually improved by leaving these substances to enrich the fields.

The first year of the woodlot project in Magaria was 1975. Six plantations were established for a total of 15 hectares. The trees planted were mainly Azadirachta indica, which accounted for about 60% of the trees planted. The secondary species planted were Anacardium occidentale, Acacia albida, Eucalyptus, Albizzia lebbek, Albizzia chevalieri, Dalbergia sissoo, and Prosipis juliflora. The first plantation was made in July, and then in August the missing trees were replaced. In June of the following year the survival was approximately 40%. The missing trees were again replaced in July, when the plantation was one year old. The fencing was done in May of 1975 and was done with grillage. Three strands of barbed-wire were used to reinforce and support the grillage. The plantations were cultivated in late July and again in September the first year and twice again during their second year.

In 1976, six more plantations were added totaling 16 hectares. The species planted were the same as the previous year, but the Neem accounted for a larger portion of the trees than before (approximately 84%). They were again planted in July and the dead replaced in August. In November of that year, the survival in five of these plantations averaged 90% with the sixth having only 20% survival. This may have been caused by the use of bare-root stock on the sixth plantation as opposed to plastic pots on the first five plantations. Also, there was a lack of rain immediately after the planting of the sixth parcel. According to Weber, "A dry spell lasting several days after planting is disatrous and can take as much as 70% of the planted trees out of circulation from the start.1 The fencing was done in early December with seven strands of barbed-wire.

This year, we have just finished planting seven more woodlots totaling 20 hectares. The Neem accounted for about 90% of the trees planted this year. Due to problems with obtaining a vehicle, the survival counts and the replacement in last year's plantations have not yet been accomplished

The Neem was chosen to make up the majority of the trees planted because of its sivilicultural characteristics. The Neem coppices and pollards well, and is widely planted for fuel, poles, and posts.2 Its minimum water requirements are about 450 mm. per year.3 Thus its minimum requirements are met at Magaria. It also stands heat well, and tolerates a period of drought of several months.4 The secondary species were planted for observational purposes only. The trees have all been planted on a 4 m. by 4 m. spacing. In northern Nigeria, when grown for poles and fuel, a spacing of 2.4 m. by 2.4 m. has normally been used on an 8 year rotation.5

This coming year, I plan to try to plant an experimental plantation or two using the closer spacing. Since being in Magaria, I have had several people ask me why we don't plants very many Eucalyptus. According to information I have read, the Eucalyptus only becomes feasible with at least 600 to 1000 mm. of rain and usually more is necessary for good growth.6 We have tried planting small numbers of Eucalyptus, but the survival rate has been very low, although I have no exact figures at present.

In the first two years, two methods of fencing have been used. The first year, grillage was used and the second year barbed-wire was used. This year, the materials have not yet arrived, so I don't know what we will have this year. In my opinion, the grillage is by far the better of the two. The grillage does a better job of keeping goats out, is a little more difficult for the villagers to sabotage, and it is easier to build a fence when one is working with villagers who don't know how to build fences.

Our biggest problem is that we do not have a vehicle at our disposal very often. Our nursery is located 15 kilometers away from Magaria. Without a vehicle, we can not visit the nursery as often as we should. Also, during the planting season, when it rains we must telephone Zinder and ask for a vehicle. If they are all busy at the time, or broken down, we wait sometimes up to two weeks before we receive a vehicle. This is true with the rest of the work also. Everything is usually finished late. Also we are rationed enough gas to do the minimum amount of work that is necessary. We are not able to check old plantations often enough to look for such things as diseases, insect attacks, or broken fences. Materials often arrive late and incomplete also.

A second project that we are involved in is the 3M project. This is a project in the Zinder Department involving the arrondissements of Magaria, Mirriah, and Matameye. It is funded by FED (Fund European du Developpement). It is currently in its second year and involves six villages for a total of 18 hectares in the Magaria arrondissement. The project was originally developed for the agriculture department. The Eaux et Forêts service became involved in the project to plant woodlots to inhibit destruction of the soil by the wind.

A third project is a reforestation project near Wacha, 110 kilometers northeast of Magaria. This project is funded by the arrondissement. It calls for 15 hectares to be planted over a three year period. The project is currently in its second year. The species planted have been the Acacia albida, Acacia senegal, and the Acacia nilotica. They are planted on an 8 m. by 8 m. spacing. Also planted at random are some Borassus aetiopum, and Hyphaene thebaica to observe how they will grow in the area. Euphorbia have been planted at the two edges of the plantation perpendicular to the wind direction.

CITATIONS

1. Weber, Fred J., 1971. Conservation and Forestry Manual : Niger pp.

2. Food and Agriculture Organization of the United Nations, 1974. Tree Planting Practices in African Savannas. pp. 49.

3. FAO, pp 44

4. FAO, pp 44

5. FAO, pp 49

6. FAO, pp 45

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Paper Presented To
THE PEACE CORPS WEST AFRICAN
FORESTRY CONFERENCE

Niamey, République du Niger
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VEGETATION/HABITAT TYPE-MAP OF PARK NATIONAL DU W DU NIGER

BY
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INTRODUCTION

I would like to present details of what has been accomplished towards mapping the vegetation of Park National du W du Niger, but at present, the project is in the early stages of planning and equipment acquisition. Therefore, the purpose of this paper is to present some methods of vegetation type-mapping and pertinent aspects to consider in preparing such a map with examples of how these will be applied to Park W. Where possible, examples from the literature will be provided to show how some of these methods have been successfully applied in preparation of vegetation type-maps. In addition to presenting the general methods of type-mapping, I would also like to provide examples of how a vegetation type-map of Park W can be utilized. This will provide the necessary justification why it is highly desirable to spend time and money in the preparation of a type-map, especially for a poor developing country where many other valuable projects could be implemented with these limiting resources.

Before proceeding any further, I think it is important to understand just what a vegetation type-map is. A vegetation type-map is an inventory of the plant communities existing at a given time and place which show the actual distribution of vegetation types in the landscape and thereby to what extent each type is actually available, valuable, and desirable.

PROCEDURE

DATA COLLECTION

The area of Park W in Niger is about 2,200 km2. A complete ground survey of the total land area, as a method to obtain the required information, is feasible but highly undesirable, because the time required to complete the job would make the task uneconomical. Besides, there are many large areas in the Park that are inaccessible by roads. An alternative information gathering system is therefore required. Fortunately, remote sensing of the environment can be done accurately and economically by photographic recording of radiated and reflected energy from the earths surface.

Several remote sensing methods may be applied, ranging from simple, relatively inexpensive black and white aerial photographs to expensive color infared Landsat photographs enlarged to the largest scale feasible. To date, only black and white overlapping aerial photographs taken in 1975 at a scale of 1:20,000 have been obtained. It would be of great value for the vegetation analysis to have an additional information source by remote sensing, such as infared Landsat photographs at a scale of 1:250,000 and in a time sequence, but funds for their purchase are presently lacking.

With the black and white aerial photographs, the ideal is to examine them stereoscopically, distingushing the difference between vegetation types by their different appearence registered upon the photographs based upon the tone, texture, patterns and other distingushing characteristics. With acetate overlaid upon the photographs, one then traces the type bounderies. In our case, because of only one set of aerial photographs, we are using the acetate to protect the photographs for future use, because cluttered photographs are very difficult if not impossible to work with. Once this has been accomplished for the entire park, these

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type bounderies can then be transferred to a polyester drafting film overlaid upon a topographic map, of a scale of 1:50,000. This is necessary in order to keep errors to a minimum because there is no possible way to construct a controlled map due to no control points being established on the ground during the aerial survey. Once this has been accomplished, we can then proceed with the ground surveys to obtain the desired information for each type that was recognized from the aerial photographs. These surveys are to be done on areas that have been choosen as a "representative type" for each kind of vegetation type. A key of this information is then constructed for each "representative type". The information we are interested in obtaining are :

1) Floristic Characteristics : The dominate species that have the highest frequencies of occurance for each life form; trees, shrubs, and grasses to obtain the whole plant community.

2) Physiognomy Characteristics : This is based on the physical characteristics, such as density, leaf characteristics, and vertical structure.

3) Environmental Characteristics : Information pertaining to the site quality, as soil type and depth, slope and direction it faces and available moisture.

Once we have these keys, this information is then extrapolated to all other types that appear similar to the "representative type" on the aerial photographs. But one should not accept this as completely accurate and stop here. Another series of ground surveys should be carried out as a spot test to make sure of the accuracy of the keys and the type information. These test surveys should be done in each individual type if economically possible, but if not, construct the surveys in the best possible way to maximize the returns with the available resources.

MAP DESIGN

Once all the important, relevant data is collected and one is confident of its accuracy, it is then time to start the actual map making. At this point, we have all the type bounderies marked out on polyester drafting film overlaid upon our topographic map. From this overlay, we trace out on paper our first map, which is called the Manuscript Map. This map will contain the most detailed information and shall be accessible as reference by anybody who desires the information, for on a large scale map, much more information is possible than on a smaller scaled map. The manuscript map usually is not published, for smaller scaled maps are more desirable and cheaper to reproduce.

CLASSIFICATION

The classification and presentation of the information concerning the vegetation types is the most important and most difficult part in the construction of a map. There exist so many methods, that the literature (Küchler, 1967; Hirst, 1975; Herlocker and Dirschl, 1972; Barkham and Rainy, 1976) on vegetation maps concerning this aspect is filled with examples in which every author thinks their method is the best approach. I shall list here just a few possible ways of presenting the vegetation

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types upon a map, and where possible, I shall explain how I hope to apply them to Park W. These are;:

1) Floristic : Listing of the plant species and their communities.

2) Physiognomy : Describing the vegetation by their physical characteristics. For the aerial survey of 1955 and the vegetation type-map which I wish to make for this time period, will be of this kind, because only a general presentation of the different types is possible as ground surveys are presently impossible.

3) Natural Vegetation: The vegetation type is presented either by what is actually growing upon the site, or what could potentially be growing upon the site.

4) The vegetation as expressed by the environment : An example here could be selecting one particular environmental feature such as available moisture and relating all plant communities to it.

5) Dynamism : Where the plant communities can be shown in their relation towards a climax community.

6) Combinations of the above : The vegetation type-map for Park W with the 1975 aerial survey, I wish to present the actual vegetation as a combination of the floristic and physiognomy features.

Once the map maker has decided upon which of the above methods they feel will achieve the purpose of the vegetation type-map, how should this information be coded upon the map? It is through the coding system that the reader will be able to extract the information that exist upon the map concerning the vegetation. It is here where the organizational skill and imagination of the map maker are put to a test. Again, the literature is full of examples with many very good systems, but it is also important to realize, that the best guiding agent as to the kind of system to employ is the vegetation itself that the map is intended to show, for no two regions have the same vegetation, therefore, they will have different methods of coding this information. But, there are three important points one must always consider when constructing and coding their map. These are :

1) Legibility : A map that is not legible either from sloppy work or cluttered with to much information is almost as worthless as no map at all.

2) Consistency: It is important that the coding and classification of the vegetation types on the map be as consistent as possible. For example, if one is listing the dominate species for each forest type, one must also list the dominate species for each grass type.

3) Standardization : A coding system is standardized if it can meet four creteria. The coding can be :

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a) used on maps of any scale

b) used in any region of the world

c) expressed in clear terminology

d) employed readily.

The importance of these could never be overstressed. All one needs to do is check the literature in which cases exist in which these weren't adhered to, resulting in maps that are worthless, wasting much time and money (U.S. Forest Service, 1934; Shantz and Zon, 1923). A good map is one that adheres to these three points, but is flexible enough to meet the needs in presenting the vegetation types of a specific local region and can be read easily by anybody who wishes to employ the map to their needs.

SCALE

I have considered and stressed the importance of legibility, consistency, and standardization in coding and classification of the vegetation types on the map. But just as equally in importance when constructing a type-map, one needs to take into serious consideration the scale of the desired map. The scale has a direct relationship to the detail of the information presented on the map, the smaller the scale, the less detail that is possible and if one keeps as much detail as possible on a map as the scale is reduced, one will find their map becoming more and more cluttered until the legibility becomes very difficult. To aid a map maker in choosing the proper scale which would best serve the purpose of their vegetation type-map, one should consider the following :

1) Availability of topographic maps. For Park W, 1:50,000 and 1:200,000 scaled maps exist permitting the construction of large and medium scaled maps.

2) Classification of the vegetation. For Park W, a large scale is desirable to enable the listing of the floristic and physical features of the vegetation because for wildlife management, this information is essential.

3) Purpose of the map. For Park W, our goal is wildlife management and park development.

4) Size of area to be mapped. Park W in Niger is about 2,200 km2, not to excessively large so a large scale map is feasible.

5) Character and structure of phytocenoses. Park W is mostly a dense Shrub-Grass vegetation type permitting a small scale map.

6) Local relief of area. Park W has a small vertical relief difference, ranging from 170 to 300 meters above sea level also permitting a small scaled map.

7) Cartographic techniques. This is yet undecided for Park W.

In considering this list for application to Park W, at the moment I can see the development of two different scaled maps. A large scale at 1:50,000, the manuscript map for use in Park development and wildlife management, and a medium scaled map at 1:200,000 that can be made available to tourists at the Park and for educational pruposes.

RELEVANT INFORMATION

One last point needs to be mentioned and that is the accompanying relevant information. A well designed and classified map with just the land area and its accompanying vegetation types on it without any other information is very useless to the map reader. There is some necessary information that should be presented on the map in a clear, legible form. This information should be :

1) Latitude and longitude.
2) Scale of map in two forms, fractional and linear.
3) Title of map.
4) Legend of the classification and coding system.
5) Name of authors.
6) Date of compilation of field work, aerial photographs, and publication.
7) Supplementary text.

A good example is Herlocker and Dirschl, 1972.

I have just presented some of the important aspects one should consider in the preparation of a vegetation type-map. These ranged from the various methods of data collection to presenting and classifying the information on a type-map. Where possible, I provided examples from the literature and described how I plan to apply these methods to the vegetation type-map of Park W. I would now like to turn our attention from these procedural methods, to presenting the reasons for the need of a type-map of any land area, and specifically, how the type-map will be applied to Park W.

APPLICATIONS TO PARK W

You may ask, and rightly so, why a vegetation type-map? Why spend large sums of time and money, in some instances, years of work and millions of dollars, in the preparation of a type-map? Surely one could find better more fruitfull projects to invest these resources. Or are there? In todays world, with its large and ever expanding human population, there is greater pressure upon the land to produce the goods that we deem necessary for our survival. This pressure upon the land to produce our needs shall not decrease or remain static, but, as time progresses, this pressure shall increase. As foresters, I feel it is our duty to protect the land, to prevent the destruction of the lands potential ability to produce these goods and services. Besides this protection, it is also necessary to find the optimum land use, where optimum implies the best adaptation of land use to the requirements of the people at any given time period, be that the present or the future. To utilize this optimum, requires sound land management policies. To find this optimum land use, requires a vegetation type-map. A type-map is an essential , and indispensible tool, in the decision making process of land management, which without one, seriously impeeds the land managers ability at formulating a workable management plan.

To help understand how a vegetation type-map of Park W can be utilized, I shall provide examples. This can be accomplished by dividing the information into five main categories ; Site Quality, Principles of Dynamism, Type Conversion for Wildlife Management, Park Development and Education.

SITE QUALITY

I just mentioned optimum land use and potential productivity of the land, but how can a vegetation type-map be utilized here? All plants have certain minimum requirements that they extract from their site for their development and reproduction. And each species will have different minimum requirements. For a simple example, a species, say Plant A, has very low minimum requirements so it can then survive on a very low quality site, where, say another species, Plant B, a more demanding species, would fail to survive. On this site, in our two plant world, only Plant A would exist. Now, if we look at ahigher quality site, be that a better developed soil or more available moisture, to mention only two variables, we will find Plant B, even though Plant A's minimum requirements are also met. Here Plant B would exist, not A, because let us say Plant B can compete more successfully than Plant A on this site. Therefore, if one knew these two species , and if they were shown on a vegetation type-map, the reader would be able to deduce the site quality by just seeing what plant community existed upon the site. In general, one can use plants and their communities as a center from which to view the environment and "measure" the quality of that site. A vegetation type-map can be used as a tool for integrating and analysing the environmental factors and the relations between them and the plant communities and in determining the potential ability of the land to produce certain goods. For Park W, we shall be able to determine what the best optimum land use could be for each vegetation type. Since the park is designated a park, we wish to know how the land can be fully utilized for Park development and wildlife management. For example, we shall be able to quantify the vegetative matter, such as foliage produced in each type, to be able to determine the carrying capacity of that type for supporting wildlife. Then, the carrying capacity of all vegetation types can be totaled (the total area of each type will also be obtained from the vegetation type-map) so a carrying capacity for the park as a whole can be determined.

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PRINCIPLE OF DYNAMISM

Going back to our definition of a vegetation type-map, it states that a map is an inventory of the plant communities existing at a given time and place. Therefore a vegetation type-map is a very useful tool in studying plant dynamism, the changing of species composition of a type due to changes of forces acting upon the vegetation. To illustrate, a few examples :

1) Climatic changes : In 1968-1973, there was a decrease in the total precipitation in the Sub-Sahara, Sudan region of West Africa. The potential change this drought may have caused upon the vegetation, such as causing certain grass, shrubs and tree species to die out, and their replacement by less moisture demanding species.

2) Animal pressure : The destruction of a vegetation type due to heavier grazing and browsing by excessively large population size, for example, elephants. Elephants are very destructive to their habitat when their population level becomes too large, by knocking down the trees that they browse they convert a forest type to a shrub type. This is now happening rapidly in large areas of Park W.

3) Fire : Fire is very important in the maintenance of some plant communities, such as grasses. Without burning on a regular bases, the grasslands of the Sudan-Wooded-Savannas would quickly be invaded by trees and shrubs at the expense of the grass communities, resulting in a reduction of the carrying capacity of the area for grazers.

In these three examples, what we have is the plant communities adjusting to these new influences, trying to reach a new equilibrium, a new climax. With a vegetation type-map prepared in 1977-78, we will in effect have a picture of the present, actual vegetation. This will be very useful in the future, when another type-map is constructed enabling comparisons to be made, to examine :

1) The progress, the vegetation has or has not made towards the establishment of a climax community for the Sudan-Wooded-Savanna region. A climax may not exist because of repeated, unmanaged, and uncontrolled burning of large areas of the park.

2) To be able to assess the impact upon the parks vegetation of uncontrolled, heavy domestic cattle grazing in the conversion of the vegetation to less palatable plant communities.

3) To assess the impact upon the parks vegetation and wildlife of the proposed large, open-pit phosphate mine with its support facilities.

4) To be able to make accurate assessments of the effects, if any, management plans have upon the parks vegetation types.

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In addition to the vegetation type map made for 1977-78, we would like to do a type-map for 1955, based on aerial photographs taken at that time. With this additional map, a historical map, we hope to be able to assess how the vegetation types have changed and to speculate as to the reasons. For instance, we may be able to assess what the drought did to the vegetation types of the park and the directions the vegetation went in adjusting to the drought. We hope also to quantify the damage being done by the large elephant population upon the forest types. If this damage is too extensive and if the future trends would continue as it presently is, we would want to devise and implement workable management plans to control the elephant population size.

TYPE CONVERSION FOR WILDLIFE MANAGEMENT

I have just mentioned several natural causes of type conversion and I would now like to consider one other cause, by man for the management of wildlife. For Park W, because of its very nature of being designated as a park, our goal is the management of the wildlife and it just happens that the best method to manage them is by the management of their habitats. Therefore, when one is considering converting one vegetation type into another, a vegetation type-map is an indispensible tool to the management planner. The type-map is needed so the planner knows what the present situation is of the areal distribution of the vegetation and only when this is known can a policy of how to go about converting the vegetation into the desired distribution be formulated and implemented. By managing the vegetation, one is managing the wildlife that utilizes that vegetation type. This has great possibilities for Park W.

At the present, the parks vegetation is broadly classified and estimated as : 88% Shrub-Savanna, 9% Forest-Savanna, and 3% Grassland (Poché, 1975). By converting large amounts of the Shrub-Savanna into a grassland with the use of proper fire management (Koster, 1977), the available grasses for consumption by the ungulates shall increase. If at the same time, with the aid of the type-map for the selection of areas for construction of many permanent water holes, the carrying capacity of the Park for the ungulates would increase dramatically. One possible benefit of this could be that with an increased population size of wildlife and with a corresponsing increase of visibility due to the removal of the dense shrubs, the probability of an animal sighting by a tourist would increase. The effect this may have is to increase the visitation of tourists to Niger and the park with the resulting increased flow of capital into Niger and the park. Also, with this increased carrying capacity and the resulting increase in animal population size, it may become economically feasible to implement a harvesting program of the wildlife as a possible inexpensive protein source.

A final point will be the general regulation of a specific species population size. There exist some species, such as Roan Antelope (Hippotragus equinus); and Korrugum (Damaliscus Korrigum), in the Park which have a very low population level. Once it is known what vegetation types that are utilized for food and shelter by these species, it may be possible to convert some vegetation types into these types to provide an incentive for an increase of their population levels to protect these rarer species.

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The regulation of a species population size can also be applied for a reverse effect, to reduce a population size because at their present level, the animals are destroying their habitat or the habitat of other species that we deem as desirable to have in the park. A good example here would be the elephants which are destroying their own habitat and that of the buffalo (Syncerus caffer) and waterbuck (Kobus ellipsiprymnus), due to their excessively large population size.

PARK DEVELOPMENT

In an underdeveloped country, a major objective of such a park is to promote tourism and associated development. Here, a vegetation type-map is of extreme value in long range park management planning. For example, development of picnic facilities are better located in a vegetation type that is more asthetically pleasing, rather than at any random point in the park. Another possible use of a type-map is aiding in the placement of roads through vegetation types that are utilized by the animals to improve sightings by tourists. This would increase tourism to the park resulting in a higher flow of capital into Nigers economy. This can be well illustrated by the East African National Parks of Kenya and Tanzania. These parks have been highly developed for tourism, with the results that tourism supports a large percentage of the economy of these countries. In general, a vegetation type-map can facilitate a search of possible areas for development.

EDUCATION

I have discussed many uses for a vegetation type-map in the management of the vegetation and wildlife of Park W. But the greatest use of a type-map, where it is very formidable tool, is for use in education. A good map can present and reveal more information more easily than presenting the same information in text form about the vegetation of a landscape. A vegetation map can also reveal more than just what the vegetation types are and their areal distribution, but also provide information on :

- principles of plant communities and ecosystems
- principles of plant community succession and climax communities
- relationships between plant communities and their physical environment
- and information about the physical environment (site quality)

For Niger, a type-map would find great use at Kolo and the University for aiding with the education of Foresters, Botanists, Agriculturists, Geographers, and other people interested in the Natural Sciences for the map would provide much information to these people about their own land. Any method that helps facilitate and improve the existing teaching process, is important enough reason in itself for having a purpose of existence.

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CONCLUSION

Many good reasons were given for the existence of a vegetation type-map of Park W, for application in the development and management of the park. It is highly desirable to undertake the mentioned proposals, but it is presently impossible because no type-map of the Park presently exists. It is not accurately known exactly what kind of plant communities that exist, their distribution, or the total area they occupy. Because of this lack of information, the optimum use of the parks land and animals are not being utilized resulting in the loss of badly needed revenues which otherwise could be reinvested in the development of Nigers economy. Besides these lost revenues, the people presently graduating from Nigers schools are not being fully educated about their own land and many important principles of plant communities and their relationship to the environment. Not only doesn't a vegetation type-map exist for any land area in Niger, but none exist for the entire Sudan-Wooded-Savanna of West Africa. One can therefore understand the importance and need for a vegetation type-map of Park W, and it is my intention to construct this map.

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REFERENCES

Barkham, J.P. and Rainy, M.E., 1976. The vegetation of the Samburu-Isiolo Game Reserve. East African Wildlife Journal Volume 14, pp 297-329.

Dirschl, H.J., and Herlocker, D.J. 1972. Vegetation of the Ngorongoro Conservation Area, Tanzania. Canadian Wildlife Service, Report Series Number 19. Ottawa.

Grunow, J.O. 1967. Objective Classification of Plant Communities : A Synecological Study in the Sourish Mixed Bushveld of Transvaal. Journal of Ecology, Vol. 55.

Hirst, S.M. 1975. Ungulate-Habitat Relationship in a South African Woodland/Savanna Ecosystem. Wildlife Monograph No. 44. The Wildlife Society, Inc.

Koster, S.H. 1977. Fire Ecology and Management in Africa. Paper presented to the First Peace Corps West African Parks/Wildlife Conference, Niamey, Niger - June 20-24,

Küchler, A.W. 1973. Problems in Classifying and Mapping Vegetation for Ecological Regionalization. Ecology, Vol. 54, No. 3.

Küchler, A.W. 1967. Vegetation Mapping. Ronald Press, New York.

Poché, R.M. 1975. A Preliminary Census of Ungulates in Park National du W du Niger. Nigerian Field, 40 (2) : 78-88

Shantz, H.L. and Zon, R. 1923. Natural Vegetation of the United States. U.S. Dept. of Agriculture. Atlas of American Agriculture.

U.S. Forest Service. 1934. Areas Charaterized by Major Forest Types, States of Alabama, Florida, Georgia, Louisiana, and Mississippi. New Orleans, La. Southern Forest Experimental Station.

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